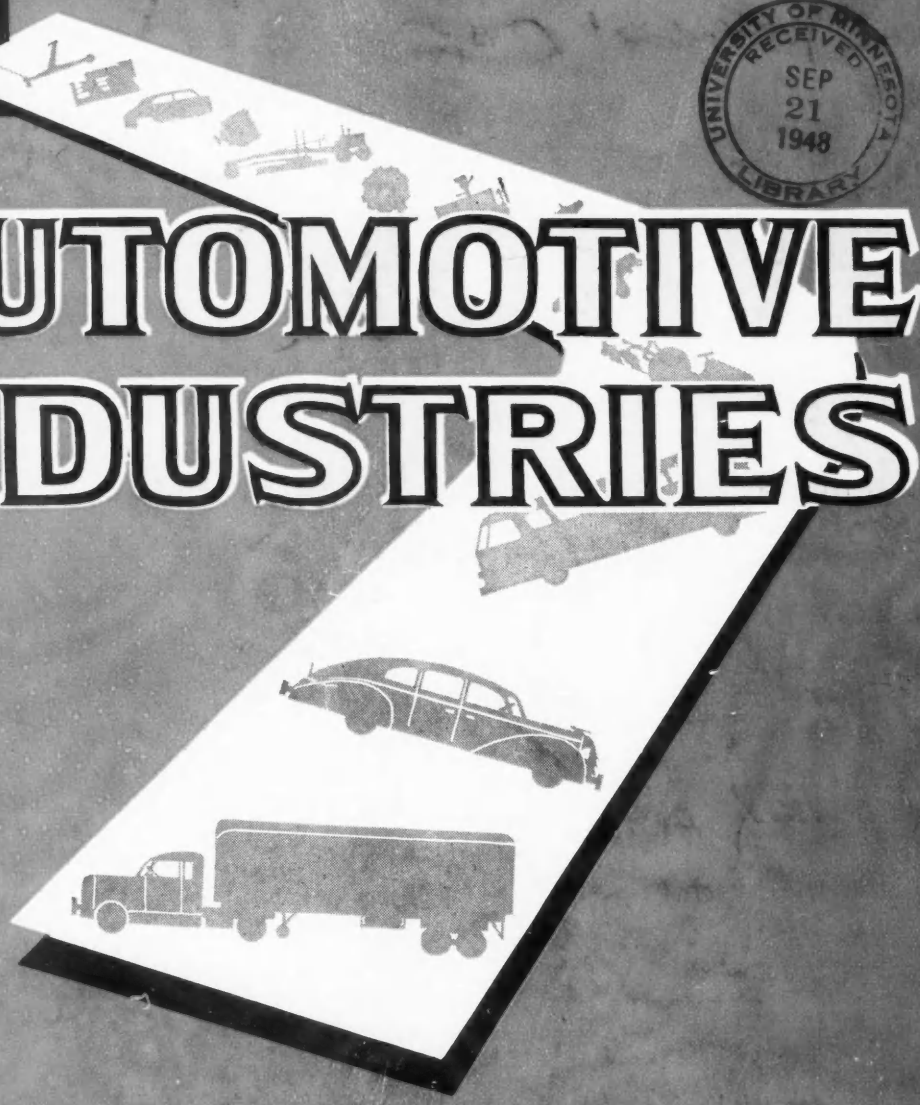
Engineering Library

TEMBER 15, 1948

UNIVERSITY OF MINNESOTA
RECEIVED
SEP
21
1948
LIBRARY

AUTOMOTIVE INDUSTRIES



IN THIS ISSUE

An Integrated Chain of Quality Controls

First Major Changes in Kaiser Models

A Small Engine with Design Innovations

Current Car Prices and Weights

Paradoxical Situations in Jet Propulsion

Complete Table of Contents, Page 3

Completely New Completely Automatic

MODEL 181 HEALD CENTERLESS

Designed for high-speed precision finishing of small parts

IT'S THE 25TH NEW HEALD MACHINE

From base to bridge, this Heald Model 181 Internal Centerless is *entirely new*. It offers many advanced features that mean long-range economy in the internal grinding of small to medium size work that can be rotated on its outside diameter.

The machining cycle is completely automatic from the time the work rolls from the loading chute until it drops out as a finished part. One operator can easily handle several machines. Like the other new Heald models, it also incorporates such outstanding features as: *New Feed Mechanism—Uniform Speeds and Feeds—Sealed Hydraulic System—Centralized Controls—Anti-friction Cross-Slide—Rapid Machine Cycles—Automatic Lubrication—Isolated Power Unit.*

The Heald principle of centerless internal grinding represents years of background and skill in producing machines that continually set the pace for high-speed precision finishing.

For complete information on this latest development in precision finishing, call your nearest Heald branch office representative.

THE HEALD MACHINE COMPANY, Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York

HEALD

AUTOMOTIVE INDUSTRIES

Published Semi-Monthly

September 15, 1948 Vol. 99, No. 6

Contents

High Spots of This Issue 15

News of the Automotive Industries 17

Profit Paradox. *By A. G. Bryant* 25

Auto-Lite's Flexible Setup 26

Car Price and Weight Table 29

1949 Kaiser Models Introduce First Major Changes. *By Joseph Geschelin* 30

Integrated Chain of Quality Controls Assures Better Truck Transmissions. *By Joseph Geschelin* 32

Airbriefs. *By Robert McLarren* 35

Design Innovations in a Small Engine 36

Radial Engine Cam Design Simplified (Part Two). *By Glenn D. Angle* 38

Jet Propulsion Can Be Efficient at Low Speeds. *By Henry C. Hill* 46

Sonic Vibrations Measure Combustion Chamber Volume 49

Bureau of Standards Laboratory 49

New Production and Plant Equipment 50

Publications Available 58

New Products 60

Calendar of Coming Events 78

Personals 82

Advertisers' Index 152

Copyright 1948 by Chilton Company (Inc.)

Owned and Published by

CHILTON COMPANY (INC.)

Executive Offices

Chestnut and 56th Streets, Philadelphia 39, Pa., U. S. A.

Officers and Directors

Jos. S. HILDRETH, *President*

Vice-Presidents

EVERIT B. TERHUNE P. M. FAHRENDORF JULIAN CHASE
THOMAS L. KANE G. C. BUZBY CHARLES J. HEALE
WILLIAM H. VALLAR, *Treasurer* JOHN BLAIR MOFFETT, *Secretary*
HARRY V. DUFFY D. ALLYN GARBER T. W. LIPPERT

GEORGE MAISWINKLE, *Asst. Treas.*

OFFICES

Philadelphia 39, Pa., Chestnut & 56th Sts.,, Phone GRanite 4-5600
New York 17, N. Y., 100 East 42nd St., Phone Murray Hill 5-8600; Chicago 1, Ill., Room 916, London Guarantee & Accident Building, Phone Franklin 4243; Detroit 2, Mich., 1015 Stephenson Bldg., Phone Madison 2090; Cleveland 14, Ohio, 1030 Guardian Bldg., Phone Cherry 4188; Washington 4, D. C., 1091 National Press Bldg., Phone District 8109 and 8110; San Francisco 5, Calif., 605 Market St., Room 608, Phone Sutter 1-4951; Los Angeles 1, Calif., 6000 Miramonte Blvd., Phone Lafayette 5525.

Cable Address ..... Autoland, Philadelphia

Member: Audit Bureau of Circulations; Associated Business Papers, Inc.

AUTOMOTIVE INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

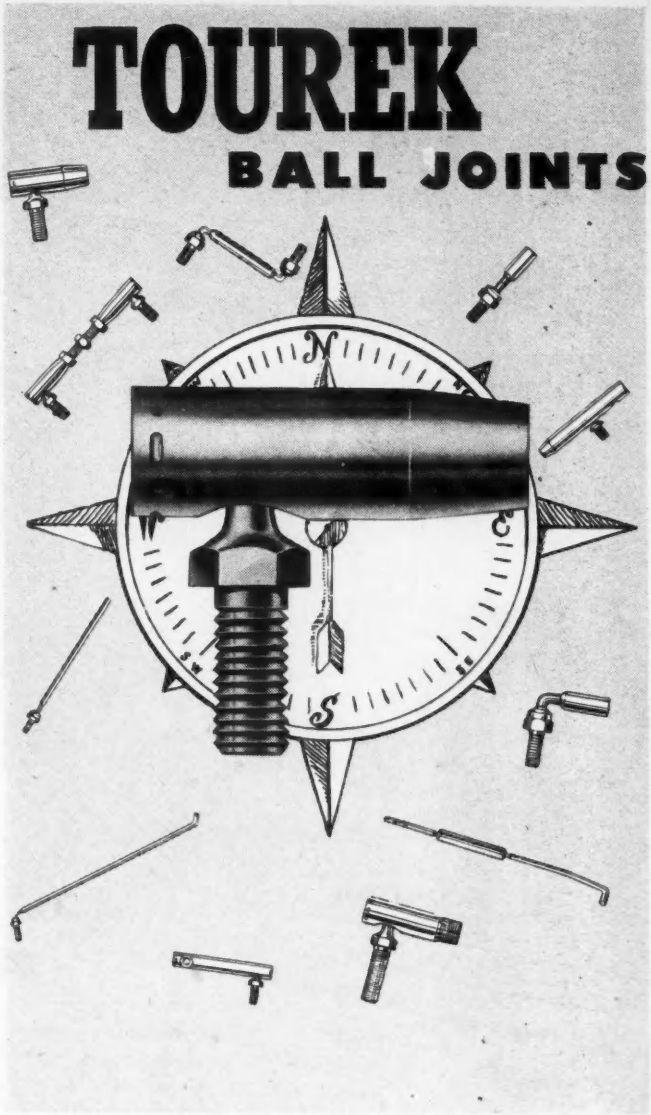
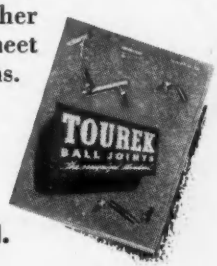


Chart your course . . .
for better product performance

Manufacturers of such widely different products as automobiles, tractors, locomotives, printing presses and scores of other products have found Tourek Ball Joints an important aid in improving the performance of their products.

Tourek's years of experience in designing and manufacturing ball joints has proved valuable to manufacturers everywhere in those cases where it is necessary to design ball joints or other precision screw machine products to meet requirements for special applications.



*Write for Tourek's 16-page ball joint catalog—it contains complete specifications on standard types and sizes, as well as data on special types.

J. J. TOUREK MFG. CO.
4701 W. 16th St., Chicago 50, Ill.

MAKERS OF PRECISION SCREW MACHINE PRODUCTS

ESTABLISHED 1920
TOUREK
FAMOUS BALL JOINTS

AUTOMOTIVE INDUSTRIES. Vol. 99, No. 6. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $2.00 per year. Canadian and Foreign $5.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

MODEL 150-TC
Triple Compression Hydraulic Baling Press for bulky sheet metal scrap . . . with cutaway view of pit and foundation.

NEWS OF INDUSTRY

Long-Term Scrap Shortage Seen As Bar To Huge Steel Expansion

Those Demanding Big Program Said to Ignore Quantities Of Scrap Required

By GEORGE F. SULLIVAN
Pittsburgh Regional Editor

Pittsburgh

• • • The additional supply of scrap that would be needed to support a whopping expansion of steel making capacity is not in sight. This is the opinion of many well informed men who buy and sell steel scrap. With prospects for this year's scrap needs none too bright they aren't the 10 or 20 million ton program proponents say that the industry would fall. Consider the industry other than supply no problem they assert that prospects for a long-term domestic scrap shortage would almost certainly ensure collapse of such a program.

Right now some big steel mills are not building up stocks fast enough to assure high operating ratios next winter. Other steel spokesmen claim they lost substantial tonnages of steel last year because of a shortage of scrap. Several responsible men on both the buying and selling end have asserted that anything near present business levels next year will get tighter rather than easier in the years ahead.

According to these people, the economists proposing a huge expansion of steelmaking capacity have overlooked the importance of obsolescence in scrap supply. Consumption that is found. If so it has not yet been brought to light.

It is estimated that only about a fourth of the 20 million gross tons of the scrap bought by steel mills last year was industrial scrap —that generated in industry as a waste product of steel fabricating. This leaves almost 15 million tons of purchased scrap that originated because things were cut or became obsolete. Of this about 2 million tons was war surplus—a non-recurring item. Even with this 2 million-ton windfall there was net obsolescence record. Recent scrap hoarding developments cast doubt on the view that there was surplus scrap last year by the industry. Some say that this year by the industry would help a lot now but it will be a nonrecurring item. Any help would be a nonrecurring item. Any help would be a nonrecurring item. Any help would

AUTOMOTIVE INDUSTRIES

EDITORIAL STAFF

Julian Chase, Vice-Pres. and Directing Editor

J. R. Custer, Associate Editor

Jos. Geschelin, Detroit Editor

H. H. Roberts, Engineering Editor

Marcus Ainsworth, Statistician

W. T. Bostelman, News Editor

Jerome H. Farris, Ass't Editor

Robert P. Homer, Ass't Editor

Leonard Westrate, News Editor, Detroit

E. J. Hardy, Washington Editor

Karl Rannells, Washington News Ed.

George H. Baker, Washington News Ed.

R. Raymond Kay, Pacific Coast Ed.

Howard Kohlbrenner, Art Director

W. F. Bradley, European Correspondent

•

Paul Wooton, Washington Member, Editorial Board

•

BUSINESS DEPARTMENT

G. C. Buzby, President and Manager Automotive Division

E. H. Miller, Adv. Mgr.

E. W. Hevner, Cir. Mgr.

•

REGIONAL BUSINESS MANAGERS

John T. Hoole, Chicago

E. E. Elder, Detroit

Nelson W. Sieber, Philadelphia

Harland E. Boyd, Cleveland

A. R. Eckel, New York

C. H. Woolley, San Francisco

August Haurin, Jr., Los Angeles

•

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

High Spots of This Issue

Auto-Lite's Flexible Setup

Manufacture of some 100 types of ignition coils and over 800 variations of distributors annually is the job of Electric Auto-Lite Co. in their new plant at Toledo, Ohio. How the company handles these many variations of product in smooth-flowing operation makes informative reading found on page 26.

1949 Kaiser Models Introduce First Major Changes

Now in full production, the 1949 Kaiser Special and DeLuxe sedans incorporate the first extensive model changes since Kaiser-Frazer Corp. introduced its line of four-door cars. Increased horsepower and new body styling are two of many details disclosed in the article on page 30.

Integrated Controls Assure Better Truck Transmissions

The Chevrolet-Toledo Division, General Motors Corp., completed a changeover for producing its heavy duty synchromesh transmissions for 1948 trucks without production interruption. How this was accomplished through a combination of quality controls, selective fitting of parts, and some unique lapping operations on improvised machines is accounted for on page 32.

Radial Engine Cam Design Simplified

Part two of an article first appearing last issue considers the numerical values of acceleration developed with multilobed ring cams for radial type engines, and discusses determination of cam lobe dimensions to conform with acceleration limitations. Charts, diagrams, and formulae aid in clarifying this discussion on page 38.

Jet Propulsion Can Be Efficient at Low Speeds

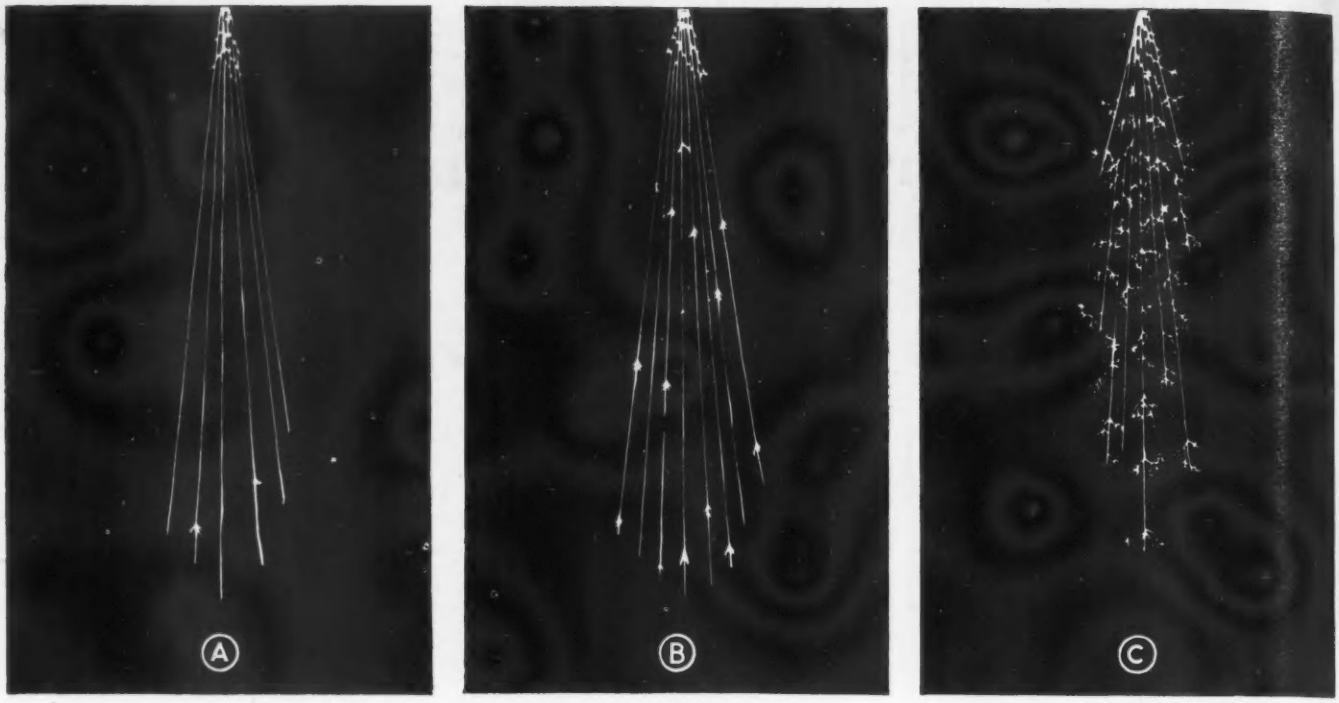
A present theory dictates that efforts should be directed toward reducing jet velocities in order to improve the efficiency of propulsion. Highly interesting conclusions along these lines open new vistas for jet propulsion power plants in long range transports and bombers, and particularly for the small airplane. A careful analysis of these points and others begins on page 46.

27 New Product Items And Other High Spots, Such As:

An editorial discussing three paradoxes relating to profits; design innovations being built into a small Reo Motor engine; a car price and weight table; and use of sonic vibrations to measure combustion chamber volume.

News of the Automotive Industries, Page 17

For Complete Table of Contents, See Page 3



Mark your answers here. Carbon content of steel A. is __% B. is __% C. is __% Correct spark readings are given at lower left

Can You Read These Sparks?

They Describe the Analyses of Three Steels

Steel bars of three different analyses gave off the sparks pictured above when touched by a revolving abrasive wheel. At Ryerson, we "read" these sparks to protect your production.

To the trained eyes of our experts, the spark pattern of a steel is as distinctive as a fingerprint. For example, the sparks shown here indicate straight carbon steels, with carbon content in the low, middle and high ranges. If chrome, nickel, molybdenum or other alloying elements were present, they would also be revealed in the spark pattern.

That's why spark testers patrol the bar sections of your nearby Ryerson plant. By checking all alloy and special quality carbon bar stock, they guard against mixed shipments. Help to assure the certified quality of Ryerson steels.

HERE ARE THE ANSWERS:

A—.10% B—.35% C—.95%

Spark testing is only one of many extra steps we take to make Ryerson a steel source you can call with confidence. Another—the special Ryerson Report sent with each alloy shipment. It charts the results of hardenability tests, shows how to heat treat for desired mechanical properties and includes other helpful data.

So play safe. Avoid the possibility of mixed steels by ordering from your nearest Ryerson plant.

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco.

PRINCIPAL PRODUCTS

BARS—carbon & alloy, hot rolled & cold fin., reinforcing
STRUCTURALS—I beams, H beams, channels, angles, etc.
PLATES—Sheared & U. M. Inland 4-Way Floor Plate
SHEETS—hot & cold rolled, many types & coatings
TUBING—Seamless & welded mechanical & boiler tubes
STAINLESS—Allegheny metal sheets, plates, tubes, etc.
MACHINERY & TOOLS

RYERSON STEEL

NEWS of the AUTOMOTIVE INDUSTRIES

Vol. 99, No. 6 September 15, 1948

See '48 Vehicle Output Over Five Million

With two thirds of the year gone, it looks as though the automobile industry will pile up a new production record this year. On Sept. 1, total U. S. production to date was estimated at 3,344,000, of which 2,421,000 were passenger cars and 923,000 trucks. On the same date a year ago, production stood at about 3,061,000, with 2,250,000 representing passenger cars and 811,000 trucks. Consequently, U. S. production with four months to go was about 283,000 units—171,000 passenger cars and 112,000 trucks—ahead of the same date a year ago. At the same time, combined U. S. and Canadian production stood at an estimated 3,459,000, compared with 3,228,000 on Sept. 1 of last year.

With the industry already well out in front of last year, with little danger of any large strikes, now that union contracts have been settled, and with most large scale model changeovers out of the way, production should hum along at a fairly rapid pace for the rest of this year. Barring some unforseen difficulty, the prospects for holding output to a reasonably high plane are good. With 17.5 working weeks left this year from the first of September, U. S. automobile and truck manufacturers will have to average no more than 100,000 units a week to pass the five million mark. This does not seem to be too difficult in view of the performance turned in during the past few months.

Kaiser-Frazer Developing Lower-Priced Car

The Kaiser-Frazer Corp. is planning to bring out within the next 18 months a lower-priced car to be sold in competition with Ford, Chevrolet, and Plymouth. Clay model work has been finished and specifications have been frozen. The 1949 Kaiser will be announced later this month with the Frazer to come later. The two lines will differ more in grille and trim treatment than do current models. A new convertible will also be announced in November, and another model entirely new in the industry will appear in December. It has the appearance of a convertible, but is built with a steel turret top covered with padding which is overlaid with a closely woven nylon fabric. A novel feature is a narrow window set in the center pillar for greater vision. All but the Kaiser special will be equipped with 112-hp engines.

Chevrolet Rolls Out 21 Millionth

The 21 millionth Chevrolet recently rolled from the assembly line at Flint, Mich., less than 10 months after the 20 millionth.

Willys First in Independent Automobile Exports

That the Jeep is fast becoming a familiar household word around the world is seen in the recent statement by Marcel F. DeMuller, vice president and general manager, Willys-Overland Export Corp., that Willys now ranks first in automobile export volume among independent automobile makers. He stated that at the end of July, Willys postwar exports totaled over 70,000 vehicles, consisting of 53,000 Jeeps, 12,000 station wagons, and over 5000 trucks of various types. During the past three years, Willys vehicles have accounted for over five per cent of the automotive exports of all United States and Canadian auto makers.

Buick 40 & Oldsmobile 60 Series Delayed, Not Shelved

Previous reports that Buick would abandon the 40 Series and that Oldsmobile would eliminate the 60 Series next year are only partially correct. Actually what appears to be the case is that both Buick and Oldsmobile will make a changeover in their larger models before the new B body, which goes onto the Buick 40 and Oldsmobile 60 models, will be ready for production. These two models will be delayed but not abandoned according to latest information.

Good August Production Despite Handicaps

August was a pretty fair production month for the automobile industry. Estimates for the period indicate a production total of about 475,000 cars and trucks in the U. S. and Canada. Considering all of the handicaps, that kind of production was little short of remarkable. The principal bottleneck was the strike at the Campbell, Wyant and Cannon foundry at Muskegon, Mich., which supplies cylinder blocks and camshafts to many companies. Hudson was out of production the entire month, and Lincoln, Ford large truck, and Ford tractor production also were hit hard by the stoppage. Ford managed to get

HIGH-STYLED HUDSON

This new Hudson convertible brougham features a Foldaway rear window hinged to fold down into the body with the top when it is lowered. The "step down" Hudson design gives the new Hudson a low silhouette. It is made in the Super Six, Commodore Six and Eight.

NEWS *of the* AUTOMOTIVE INDUSTRIES

AUSTIN ARRIVAL

The Austin Motor Co., Ltd. (England) is now introducing this half-ton panel truck in the U. S. The same 40-hp, four-cyl engine used in the Dorset and Devon powers this Austin truck which has an overall length of 13 ft, 1.5 in. The interior height of the body is 3 ft, 7 in., and it has a capacity of 116 cu ft.

back into production by producing cylinder blocks and camshafts at its Rouge foundry. Hudson came back into production the last day of the month by obtaining blocks from an alternate source. Packard was down one week because of a parts shortage. The most amazing performance of all was put on by the Chrysler Corp. which was able to keep operating by resorting to its Dodge forge facilities for camshafts by scouring alternate sources, and by limiting replacement parts and engine production, and by even calling in parts from the field. Another important factor was the release of stocks from the struck CWC foundry and New Haven foundry, which had built up supplies while Chrysler was on strike last spring. Add to all these difficulties the idle assembly lines at Nash all month for model changeover, the strike at International Harvester, and the heat walkouts and authorized closing down of assembly lines, and it is all the more remarkable that the industry could turn out in August nearly as many units as it did in July, which was a good month.

Hudson Raises Car Prices Average 4%

The Hudson Motor Car Co. has increased prices of its cars an average of four per cent, the second increase this year. Prices had previously been raised on June 19 following wage increases to Hudson employees. The company said that price advances were due to increased costs of raw and finished materials, high freight rates, and other expenses. Dollarwise, the increases ranged from $75 to $95.

Ford Hits New High In Postwar Output

The completion of Ford Motor Co.'s four new postwar assembly plants has begun to bear fruit. The last two weeks in July, the company set new postwar records with the highest week totaling 26,128 units. Most of the increase is accounted for by the new assembly plants which consist of Lincoln-Mercury units at Metuchen, N. J., St. Louis, and Los Angeles, and a Ford plant at Atlanta.

GM's Vauxhall Producing Two New Models

Designed primarily for the export market, two new streamlined models, the six-cyl Velox and the four-cyl Wyvern have been announced by Vauxhall Motors, GM's British subsidiary. Now in production, the Velox is priced at $1720, $120 cheaper than the Vauxhall 14 which it replaces, while the Wyvern, replacing the Vauxhall 12, is listed at $1400 at the factory.

GM Gives 3¢ Boost Under Cost of Living Plan

GM's payrolls were increased sharply by the first quarterly adjustment under the cost of living formula which is an essential part of the contract GM signed with the CIO last spring. Effective Sept. 6, hourly-rated employees get three cents an hour more under the formula agreement, bringing the average hourly wage for GM's automobile production workers to about $1.64 an hour. At the same time, salaried employees will receive $25 during September representing a cost of living adjustment for the preceding three months. During December eligible salaried employees will get an additional $15 as a cost of living adjustment for the period between Sept. 1 and Dec. 1. Under the formula, wages and salaries are tied to increases or decreases in the BLS Consumer Price Index.

REPAIRS ON THE ROAD

Recently put into operation by California's Kern County, this traveling blacksmith and welding shop mounted on a Mack chassis and fully equipped with forge and tools is proving very successful in effecting on-the-job repairs in the 8170 sq mi of the third largest county in California

NEWS *of the* AUTOMOTIVE INDUSTRIES

Nash Spends $15 Million Preparing '49 Model

One very important factor in the increasing price of new automobiles is the cost of tools, dies, jigs, fixtures, and other preparation expenses of bringing out new models. Nash reveals that in getting ready for production of 1949 models to be publicly introduced late in October, all previous major body assembly line equipment and all body dies were discarded, and that the cost of development and changeover to new models was approximately $15 million. The cost of tooling for the new Hudson convertible was more than the company spent in prewar years to re-tool its entire line. Kaiser-Frazer spent more than one million dollars for dies and other costs in developing its new hard top convertible.

Playboy Tooling Up for Volume Output

The Playboy Motor Car Corp. said that it is proceeding with its tooling program for volume output and has "reasonable assurance" of adequate materials for mass production. Playboy expects to spend about $12 million to tool and equip its plant in Buffalo, and President Louis Horwitz stated that some mass-production machinery, such as presses and welding equipment, has already been delivered, and that more has been or will be ordered. Volume production, Mr. Horwitz disclosed, may start before the end of 1948, but may take longer because of inevitable delays in taking delivery of new machinery and in setting it up.

Ford Plant in Cologne Building Trucks

The latest report on the Ford Motor Co.'s plant in Cologne, Germany, is that, although the plant was damaged during World War II, it has been producing Ford-Taunus trucks since the end of the war, and in 1947, 2599 of these units were built. Currently, about 3600 persons are employed, and approximately 1.9 million sq ft of the plant is under cover. Started in 1926 as an assembly plant, and converted into a manufacturing unit in 1930, the plant, by the end of 1947, had assembled or produced 245,470 cars and trucks.

GMC Truck Production in July Sets New Peak

GM's GMC Truck & Coach Div. had its largest domestic truck production month in July with a total of 8753 units. Highest daily output was 601 trucks which was a new record for domestic production.

Studebaker Shipping Parts for Overseas Assembly

The Studebaker Corp. has started volume shipments of complete sets of components for assembly of passenger cars and trucks in overseas plants. The company has nine foreign assembly and manufacturing plants owned and operated by distributors and located in India, South Africa, Brazil, Belgium, Denmark, Sweden, Mexico, Egypt, and Eire. Plans are under consideration for operation in the Argentine and other countries.

K-F Makes Pig Iron Deal With Republic

Under its agreement with the Republic Steel Corp., Kaiser-Frazer will buy 5000 tons of pig iron a month from the Cleveland blast furnace which K-F has leased from WAA. Republic will operate the facility until either May 1 or Nov. 1, 1949, in order to have time to erect a new blast furnace to take care of its regular customers, and Republic will pay K-F $1.40 a ton rental, which is 10 cents a ton less than K-F pays the government. It is estimated that it will cost K-F about $100,000 a year under the arrangement.

New Cadillac Engine Much More Powerful

There is considerable speculation in Detroit about the new engines under development by Cadillac and Oldsmobile for introduction on 1949 models. Both are V-8's with compression ratios of about 8 to 1. The Cadillac engine is said to develop approximately 170 hp. There is much interest in the fuel economy of the engines. Undoubtedly, they will require the highest octane fuels available at gasoline station pumps. A possible hint on fuel economy is contained in a statement from a paper delivered by John M. Campbell and Lloyd L. Withrow of GM Research Laboratories before the American Chemical Society recently. They said that with an 8 to 1 ratio "gains in economy as high as 25 per cent were realized at octane levels not much above those established by some present premium gasolines."

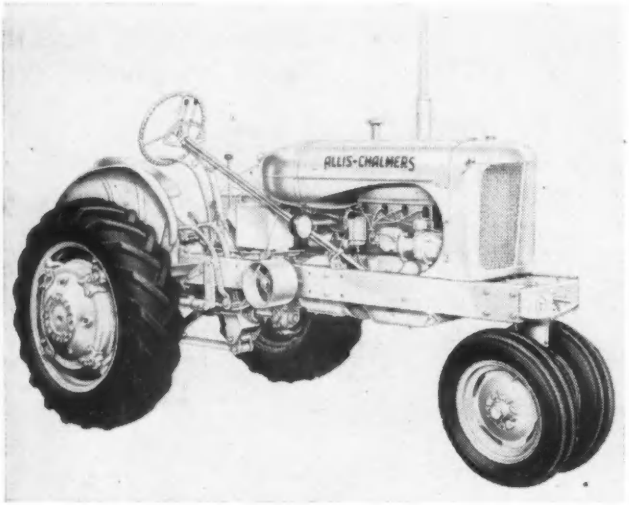
CLASSY FOR THE CHASSIS

Built by the Engineering and Research Corp., makers of the Ercoupe personal plane, Riverdale, Md., this new Ercovan forward-control truck body is especially adapted to the Chevrolet forward-control chassis with a 125¼ in. wheelbase. Weighing 1075 lb. the body features light weight aluminum construction, and has a capacity of 360 cu. ft.

Kaiser to Build Boat Powered by Allison

Henry J. Kaiser, president, Kaiser-Frazer Corp., will attempt next year to bring the world speed boat record to the U. S. He has completed contract arrangements with the Ventor Boat Corp. to build a boat powered by an Allison engine of approximately 3000 hp. Power will be transmitted through two gear boxes with an approximate 4

NEWS *of the* AUTOMOTIVE INDUSTRIES



TREAD CHANGING TRACTOR

Now in production, Allis-Chalmers' new full two-plow, general purpose farm tractor, Model WD, features automatic rear wheel power tread adjustment which permits the operator to use engine power to adjust the wheel treads to the desired spacing without leaving his seat.

to 1 ratio which will give the two synchronized propellers a speed of 12,000 rpm when the engine is turning at 3000 rpm. The overall length of the craft is to be 36 ft; width, 14 ft; and weight, approximately 6000 lb.

Dodge Dealers Are Spending Millions for Expansion

Chrysler Corp.'s Dodge Div. reveals that its dealer body has spent more than $73 million for new or enlarged buildings alone, with the average per dealership slightly more than $18,000. In addition, several million dollars more were spent on modern tools and equipment. Also, during the past two years a large number of Dodge dealers have built exclusive truck facilities entirely apart from their passenger car operations.

Willys Resumes Output of Station Wagons & Sedans

Willys-Overland Motors early this month was able to resume production of Jeep station wagons and station sedans. Production on these models had been suspended for two months during the transfer of dies, jigs, and fixtures from Hayes Mfg. Co. to Briggs, the new Willys supplier. The company has also announced that the list price of the station wagon has been raised six per cent, the first price increase on that particular model in more than a year.

Leyland Forms Company in Canada

Leyland Motors, Ltd., Lancashire, England, has announced the formation of a new Canadian company which will be known as Leyland Motors (Canada), Ltd., for the production of vehicles equipped with the Leyland diesel engines. The headquarters and works of Leyland Motors (Canada), Ltd., are located at Malton, Ontario. As one of the oldest leading British manufacturers of diesel engined trucks, buses and industrial power units, Leyland Motors of England has for the past 30 years maintained direct branches in Canada. This new company, with a capitalization of $3 million, will take over the activities of the Canadian branches of Leyland of England and will produce Leyland diesel engined vehicles for the Canadian market.

Litchfield Sees Tire Demand Still Outstripping Output

Despite the flood of tires produced in the postwar period, a strong demand level continues, P. W. Litchfield, chairman, Goodyear Tire & Rubber Co. recently indicated in pointing out that the outlook for total tire production for 1948, even with an expected seasonal decline in the fourth quarter, is for some 86 million tires against last year's all-time record of 100 million and between 60 million and 63 million in the best of the prewar years. Mr. Litchfield emphasized that the replacement demand for passenger car tires in 1949 would exceed this year's estimated output of 40.5 million tires and that the replacement demand for truck and bus tires would equal the 1948 production of approximately. 7.5 million. Current estimates for 1949, he said, put the demand at 81 million tires.

Studebaker's Canadian Plant Now in Production

The first passenger car recently emerged from the final assembly line of the Studebaker Corp. of Canada's new one-story plant covering about 7.5 acres in Hamilton, Ontario.

Douglas Developing New Air Force Trainer

A new low-winged military training plane with tricycle landing gear is now in the engineering study and development stage at Douglas Aircraft Co. under a $550,000 Air Force contract which calls for the construction of a mock-up. The new plane's design features a submerged Wright R-1300 air-cooled, radial engine, within the fuselage immediately aft of cockpit and over the wings, driving a tractor pro-

1948 MOTOR VEHICLE FACTORY SALES FROM U. S. PLANTS*

	Passenger Cars	Trucks	Buses	Totals 1948	Totals 1947
January	305,081	99,200	1,370	405,651	347,696
February	274,847	107,054	1,090	382,991	373,360
March	349,998	140,606	1,409	492,013	421,180
April	308,071	128,963	1,048	438,082	423,399
May	225,461	111,789	1,281	338,531	382,640
June	312,406	117,572	1,065	431,033	400,372
Total—Six Months	1,775,864	705,184	7,253	2,488,301	2,348,647
July	356,582	116,802	1,002	474,387	379,192
Total—Seven Months	2,132,446	821,986	8,256	2,962,688	2,727,839

1948 FACTORY SALES TO DOMESTIC AND FOREIGN MARKETS*

	Passenger Cars		Trucks		Buses	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	285,373	19,708	83,893	15,307	1,068	302
February	256,753	18,094	88,889	18,165	752	338
March	327,198	22,800	118,572	22,034	1,202	207
April	283,356	19,715	111,911	17,052	902	146
May	209,591	15,870	96,909	14,880	1,161	120
June	293,582	18,824	101,755	15,817	879	176
Total—Six Months	1,660,853	115,011	601,929	103,255	5,964	1,289
July	334,684	21,898	98,271	18,531	938	65
Total—Seven Months	1,995,537	136,909	700,200	121,786	6,902	1,354

*Automobile Manufacturers Association.

peller by shaft under the cockpit floor. This arrangement permits the location of both tandem seats forward of the wing and gives the trainer the visibility characteristics of a jet airplane. It is felt that this engine arrangement improves aerodynamic performance and permits the placement of the nose wheel so that it will give superior ground handling characteristics.

GM Names Armstrong Head of Chevrolet

W. F. Armstrong has been named general manager of GM's Chevrolet Motor Div., succeeding Nicholas Dreystadt who recently died. Mr. Armstrong, a vice-president of GM, has been in charge of the GM manufacturing and real estate staff.

Six Cyl Engine to Power New Australian "Holden"

Although specifications and price have not as yet been officially announced, the new Australian car to be mass-produced by General Motors-Holdens, Ltd., will be powered, it is understood, by a six-cylinder engine developing about 60 hp. To be named the Holden, the car is expected to sell for $1920.

Steel Shortage Cuts Studebaker Output

Because of the critical steel shortage, Studebaker will operate only four days a week during September. Production is expected to be 18,000 cars and trucks, compared with more than 23,000 in the peak month of June.

Lebanon to Use British Casting Process

Anglo-American cooperation has received another boost with the recent announcement that the Lebanon Steel Foundry, Lebanon, Pa., had acquired secret British super-alloy steel casting processes to be used in the production of turbojet engine components. The outgrowth of extended negotiations with Firth-Vickers Stainless Steels, Ltd., of Sheffield, England. This makes available to American industry the newest techniques of permanent mold centrifugal casting, the Centri-Die casting process. This process is said to have made possible the famous Rolls-Royce, De Havilland, Bristol, Metropolitan-Vickers, Armstrong Siddeley, Napier and other British-jet engines. Under the terms of the new agreement. Lebanon Steel Foundry becomes exclusive American licensee, with full access to Firth-Vickers patents, patterns and techniques.

SELF-SEALING GIANT

This 3000-gal airplane gasoline tank, reportedly the world's largest, was designed and built by the Firestone Tire & Rubber Co. of California for the Consolidated - Vultee six - engined B - 36. Shown being lifted by a mobile Army crane, the self-sealing tank is protected from bullet and shell fragment damage by a combination of natural and synthetic rubber, glass fiber, and nylon.

Tucker Corp. Reports Deal Pending on Financing

The latest on the Tucker Corp. financing situation is that the company "has signed an option agreement with a very substantial financing group." In his letter to dealers telling them of the arrangement, Preston Tucker, president, did not name the financing group and there was no comment from the company officials on the question. He did reveal, however, that management of the company under the proposed arrangement would remain unchanged and that he had signed a 10-year agreement as president or chairman of the board.

New "Sandwich" Material for Supersonic Planes

To protect them against the vibration and heat of their terrific velocity, facilitate their construction and even increase their speed, a special lightweight 'sandwich" material has been developed for manufacturing supersonic aircraft, Norman E. Wahl, head of the Wood and Plastics Section of the Cornell Aeronautical Laboratory, Buffalo, N. Y., recently declared before the Plastics Group of the American Chemical Society's Div. of Paint, Varnish and Plastics Chemistry. The "bread" in this new combination of materials can be a thin layer of plywood, metal or plastic laminate, and the synthetic adhesive holding the core materials to the sandwich faces can be likened to butter, Mr. Wahl stated, and "meat," or core of the "sandwich," consists of a lightweight foamed plastic, rubber, balsa wood, or a cellular honeycomb substance.

Urge Agency for Return of German Scrap

The immediate establishment of a single American organization to control scrap purchasing and selling in dealing with German steel scrap has been recommended by Robert W. Walcott, president of the Lukens Steel Co. His report, as head of two industrial committees set up to investigate return of scrap from Germany, has been made public in part by the American Iron and Steel Institute. The report said that points in dispute were what share of the scrap should go to the U. S.; whether the 600,000 tons of scrap the British already have collected should be included in fixing further shares; and proper prices for export sales. Currently, shipment of scrap from Germany is under embargo pending the completion of a British-American agreement.

Make Chryslers & DeSotos in Los Angeles Plant

Chrysler's assembly plant in Los Angeles, Calif., has added current model Chrysler and De Soto passenger cars to its production. Output began on a limited basis with Chrysler Royal and Windsor, and De Soto de luxe and custom models. Dodge passenger cars and trucks are now being produced in a new Dodge assembly plant in San Leandro, Calif.

NEWS *of the* AUTOMOTIVE INDUSTRIES

NADA Estimates Car Orders At 7 Million

Unfilled orders for automobiles continue to mount dizzily. Since the first of the year, the backlog has increased 11 per cent, according to a tabulation by NADA, and now stands at an estimated 7.3 million. The estimate is higher than those of the manufacturers, since it does not make allowance for duplications, but the general belief is that the number of valid orders is in the neighborhood of six million.

Dodge Raises Truck Prices $25 to $60

The latest price increase in the automobile industry is a jump of $25 to $60 on trucks by Chrysler Corp.'s Dodge Div. The increase is the second this year, and followed by two weeks a boost in the price of the corporation's passenger cars, also the second in 1948.

NADA May Add Truck Equipment at Show

The National Automobile Dealers Association may include a truck equipment division in its dealers equipment display at the 1950 convention to be held in Atlantic City. The exhibition of equipment used by dealers in their shops was inaugurated at the 1948 convention and will be repeated at the convention to be held in San Francisco next Jan. 24-27. The 1949 show will include some truck service items, but it has been suggested that a separate and enlarged division devoted entirely to such equipment be included in 1950. All items displayed are for the dealers use and do not include those purchased for resale.

Test Fly Small Italian Amphibian

Successfully test flown recently at Savona, Italy, the P-136, an Italian twin-engined metal amphibian plane, said to be the world's smallest, is about 30 ft long, and has a wing span of about 42 ft. It is powered by two 215-hp engines, and has a cruising speed of 186 mph. Designed by Giovanni Cairaghi, the plane was built by the Piaggio Co., Italy.

Hughes Buys Rights for XH-17 Jet Helicopter

Offering $150,000, the Hughes Tool Co., parent firm of the Hughes Aircraft Co., has acquired the rights, including a government contract, for the production of the jet-propelled XH-17 helicopter from the Kellett Aircraft Co.

Motor Vehicles for Greece Holland Under ECA

The first substantial motor vehicle procurement authorizations under the ERP have been approved by the ECA. They involve $1.5 million worth of American trucks to be shipped to The Netherlands and $500,000 worth of motor vehicles and spares to Greece. The purchases for Holland are to include 750 light and medium trucks, 160 delivery vans, and 85 tractors.

Hawker-Siddeley Buys A. V. Roe Plant

The A. V. Roe plant at Malton, Ont., Canada, has been purchased outright by the Hawker-Siddeley Aircraft Co. of England, the parent firm. It is believed that Hawker-Siddeley intends a continuation and expansion of the development of jet-engined transports now being carried on at the Malton factory.

Danny Foster Wins Gold Cup Again

America's motorboat racing classic, the Gold Cup Race, was won, as in 1947, by Danny Foster, this time in Miss Great Lakes in the rough water of the Detroit River. Warren Avis in Miss Frostie was the only other entry to finish.

New Manufacturing Plant Being Built by Timken

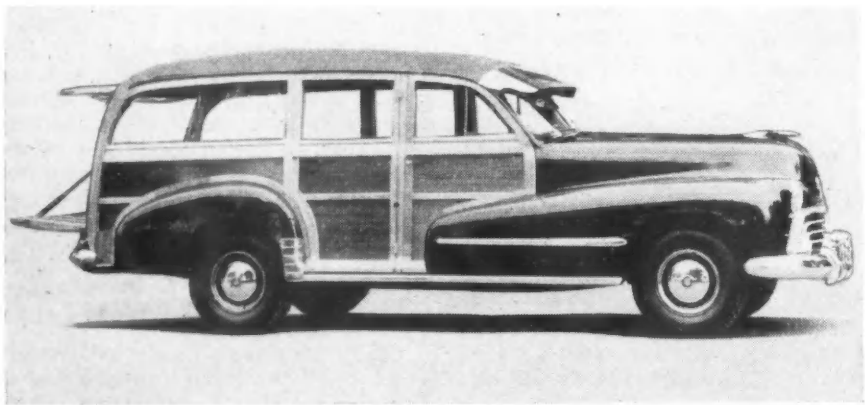
The Timken Detroit Axle Co. is building a new manufacturing plant at Kenton, O. The plant will have 135,000 sq ft of floor space. It is reported that the location of the plant was in accordance with recommendations of the National Resources Planning Board that industrial plants be more dispersed as a security measure. The new plant will employ 400 to 500 persons and will replace two plants leased from the government during the war.

United Aircraft to Deliver JT-6 Turbojets in '48

Further development and refinement of its JT-6 turbojet engine (the basic design of which is under license from Rolls-Royce of England) is proceeding satisfactorily, United Aircraft's Pratt & Whitney Aircraft Div. disclosed recently. Production of the first model is well underway, and it is expected that deliveries will be started in the last quarter of this year.

Iron Shortage Forcing Use of Inferior Scrap

An example of the critical scrap shortage is evident from a visit to steel mills. Furnaces are charged with every conceivable type of metal that can be obtained, and as a result considerable difficulty is encountered in maintaining the quality of the steel. In one mill, the foreman pointed to a large quantity of barbed wire being charged into the furnace, and commented that in prewar



ROOMIER LUXURY

GM's Oldsmobile Div. recently announced that this new de luxe station wagon in the series 60 Dynamic model is now in production, offering finer interior appointments and more luggage space than in the standard model. In the new model, the back and cushion of the rear seat fold forward and downward to form a level carpeted floor seven ft in length from the back of the driver's seat to the tail gate.

NEWS *of the* AUTOMOTIVE INDUSTRIES

days that type of scrap would not even be permitted on the company's property.

Navy's Mars Shatters Non-Stop Record

Eclipsing former distance records, the Navy's Caroline Mars flew a distance of 4748 miles non-stop from Honolulu, Hawaii, to Chicago in 24 hr and 9 min, carrying a payload equal to 14,049 lb, a crew of 19, and 23 passengers. The plane, powered by four Pratt & Whitney 3000-hp Wasp Major engines, averaged 193 mph for the trip.

British Also Troubled By Piece Work Rates

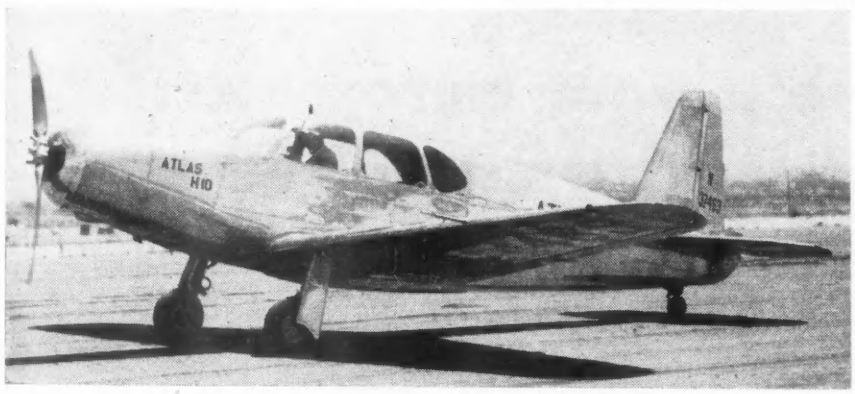
American automobile manufacturers are not the only ones who have trouble with labor unions over rates of pay on automatic machines. In England, the Austin Motor Car Co. recently had a five-day strike over the piece work rate for running a new American multiple gear cutter. The workers refused to accept the rates of pay set which were based upon the speed at which the machine could be operated.

LUXURY FEEDING

Now in production at the Percival Aircraft Ltd. factory in Bedfordshire, England, the Prince, powered by two Alvis Leonides engines each developing 520 hp at take-off, has been especially designed for feeder line operation. This ten place medium transport is essentially a miniature luxury airliner, but it can also be readily converted for freight transport.

Patterson Made Manager of Ford Rouge Operation

C. H. Patterson has been made general production manager of automotive manufacturing operations at the Rouge plant by The Ford Motor Co. He was formerly assistant to the general manager of the Ford Rouge automotive manufacturing operations.



FLYING ATLAS

Planning to deliver this four-place, all-metal plane, the Atlas H-10, for about $3000, fat, at any of the seven regional assembly plants, the Atlas Aircraft Co., Hemet, Calif., states that the plane will be powered by a 220-hp engine and will have a wing span of 35 ft, 9in.; overall length of 28 ft, 4 in. and overall height of 8 ft, 2 in.

ICC Amends Towing Safety Regulations

The ICC has amended its safety regulations covering drive-a-way operations and tow bar and saddle-mount requirements. Specifications for tow bars for towing vehicles of less than 5000 lb or more are prescribed by these regulations, and safety chains or cables are also required.

British Unions Reject Joint Industry Control

The Trades Union Congress in Britain has taken a surprising stand on the demands of British workers for joint control of nationalized industry. Contrary to the views held by some American labor leaders, the TUC feels that qualifications required for trade union officials are not necessarily those needed to run industry. The belief is similar to that recently expressed by Chancellor Cripps who was criticized by his constituents for his views.

Fruehauf Trailer Raises Prices on Some Models

The Fruehauf Trailer Co. has raised prices on certain models of its trailers and truck bodies. Rising costs of steel, parts, and labor were given as reasons. Further cost studies are being made on models which were not raised, and prices will be held on these, if possible.

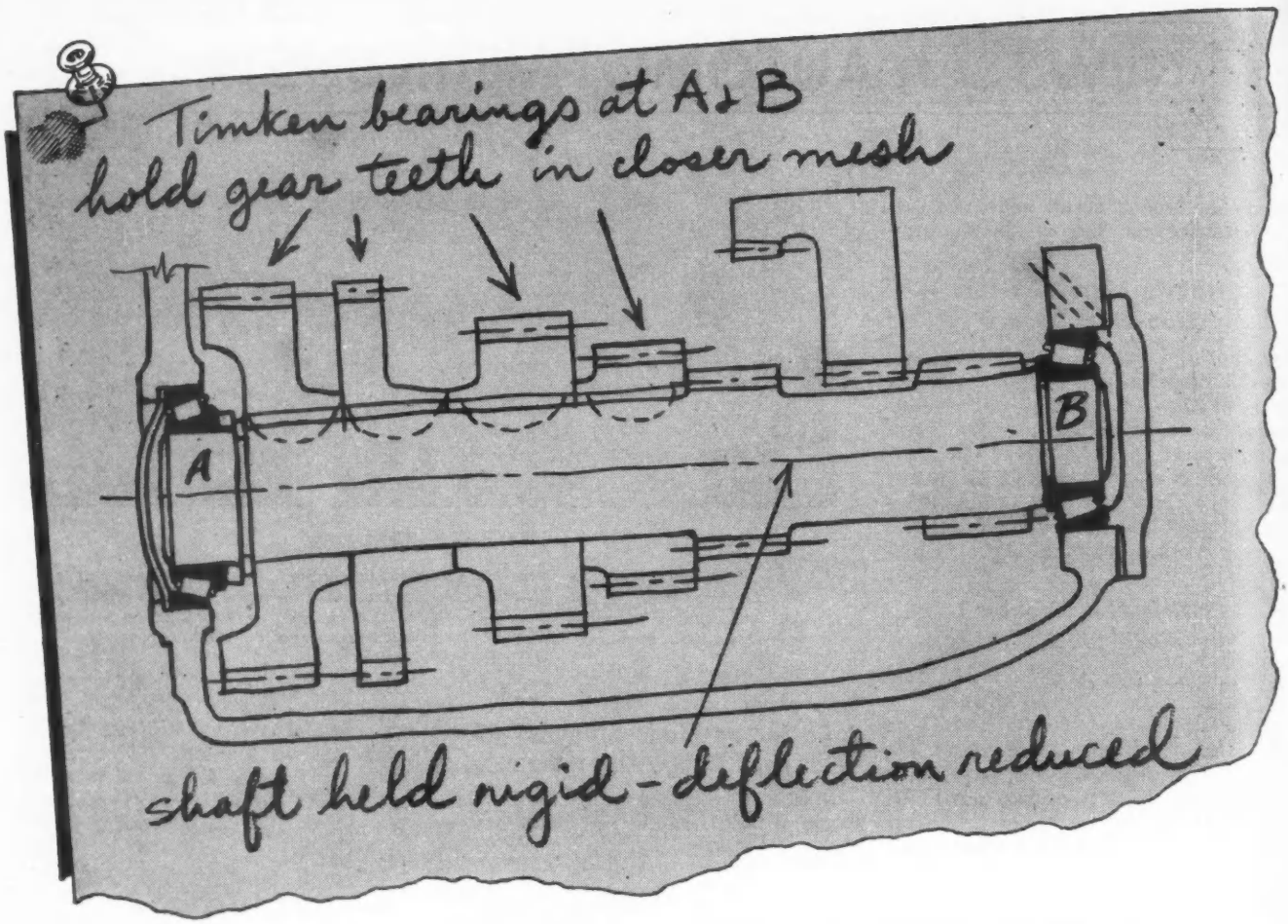
Trico Builds Addition to Buffalo Plant

To be devoted primarily to the production of the Lift-O-Matic air-powered system designed to provide touch-button control for automobile windows, a $1,250,000 addition to one of the five Trico Products Corp.'s plants in the Buffalo, N. Y., area has been started. The new building will adjoin the former Ford plant which Trico acquired in 1945.

Lincoln Arc Announces 48-49 Award Program

The Trustees of The James F. Lincoln Arc Welding Foundation have announced Sept. 15, 1948, to April 1, 1949, as the period for submitting entries in its annual Engineering Undergraduate Award and Scholarship Program, which offers to engineering undergraduates the opportunity to compete in the preparation of papers on various phases of welding.

(*Turn to page* 90, *please*)



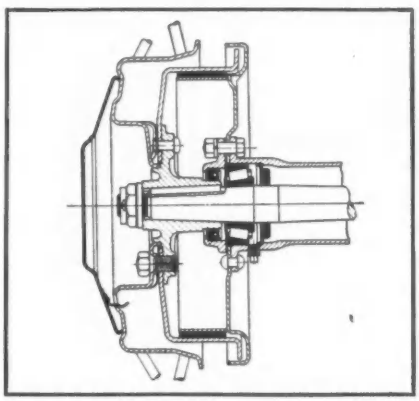
How to help your automatic transmission lead a care-free life

AN easy way to insure a long, trouble-free life for your automatic transmission is to use Timken tapered roller bearings on the countershaft.

Due to the line contact between rolls and races, Timken bearings have greater load-carrying capacity. They hold the shaft in rigid alignment, keep gears meshing smoothly. Deflection and end-movement are eliminated. There's less chance of wear . . . more years of smooth, quiet, trouble-free operation.

Because Timken bearings are tapered they carry both radial and thrust loads in any combination. Designs can be simplified because there's no need for separate thrust bearings or washers. And since Timken bearings can be adjusted permanently at installation, machining tolerances of surrounding parts don't need to be as close.

LOOK AT REAR WHEELS FOR EXAMPLE . . . Here, and in many other automotive applications, Timken tapered roller bearings have long since proved their ability to take the toughest loads in any combination.



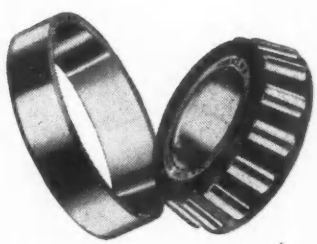
Our engineering facilities are always at your disposal. Feel free to call upon us for help or information about the bearing applications in your design. If you're designing an automatic transmission — CALL IN TIMKEN—NOW! In Detroit, phone TRinity 5-1380. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

NOTE TO P. A.'s *Because every step of the manufacture of Timken bearings is controlled within our company... because our vast manufacturing facilities are widely dispersed... you will find the Timken Company a supply source of outstanding reliability.*

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION →✳←

PROFIT PARADOX

By A. G. Bryant
President National Machine Tool Builders Association

IN HIS STATE of the Union message to Congress on January 7, 1948, President Truman made this statement: "We are today far short of the industrial capacity we need for a growing future. At least $50 billion should be invested by industry to improve and expand our productive facilities over the next few years."*

No industrialist of the capital goods industry, familiar with the need for rehabilitation of American manufacturing facilities, has any disposition to question the soundness of this observation of the President. Much of our industrial plant needs modernizing and, with present full employment of labor, more efficient facilities must be installed if we are to meet the world's requirements for goods and if are to check the spiral of price inflation influenced by shortages.

We know, for example, that more than 90 per cent of all the machine tools in use in the United States today, including those produced during the war, are of designs that are now more than ten years old. Present models of machine tools are, on a weighted average, at least one-third more efficient than those built during the war. Considering the fact that most of our machines are even older than those used in the war, metalworking production in this country could be increased more than 50 per cent if only present-day machine tools could replace those now in use. A similar conclusion could be reached as to other durable facilities.

The fact that this condition, headlined by the President's statement, now exists, furnishes one of the paradoxes now identified with the subject of profits. How else can industry invest billions in the improvement and expansion of its productive facilities if it is unable to draw upon profits for the funds? The recent announcement by the Department of Commerce that estimated expenditures in 1948 for new plant and equipment would total $18.7 billion indicates the extent of financing required. Certainly a large share of this total must come out of industry's current earnings.

Yet, the country has on the one hand an element which scorns and condemns those companies fortunate enough to show a profit and on the other hand an element which attempts to apologize on behalf of industry for such success as business has had in earning profits.

Profits are the incentive without which there could be no industrial enterprise. Profits are the source of funds to provide the facilities which furnish jobs and produce goods. Only through profits can business progress. Only through profits can business continue to employ labor and manufacture the public's requirements. Over a half century ago President Grover Cleveland made this significant comment: "The wage earner must always rely for work on the ventures of confident and contented capital."

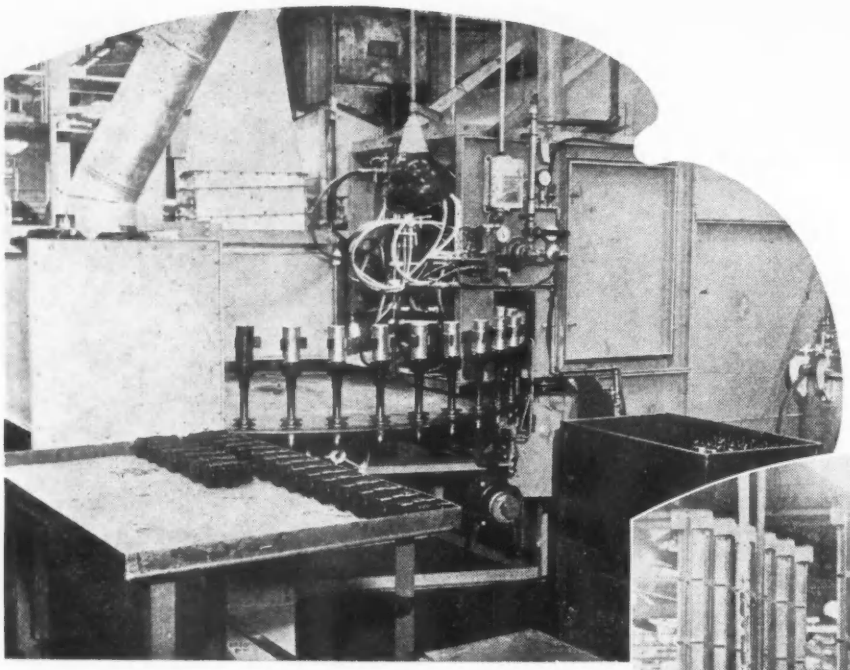
We must contemplate three paradoxes now related to the profit position of business. The first of these rests in the apparent conclusion by a portion of the public that the earning of a satisfactory profit is inconsistent with sound public welfare, that there is something dishonest about earning a healthy profit, that, by keeping profits low, labor and the public will benefit.

A widespread acceptance of these fallacies makes necessary a restatement of some fundamental economic facts. (*Please turn to page* 86)

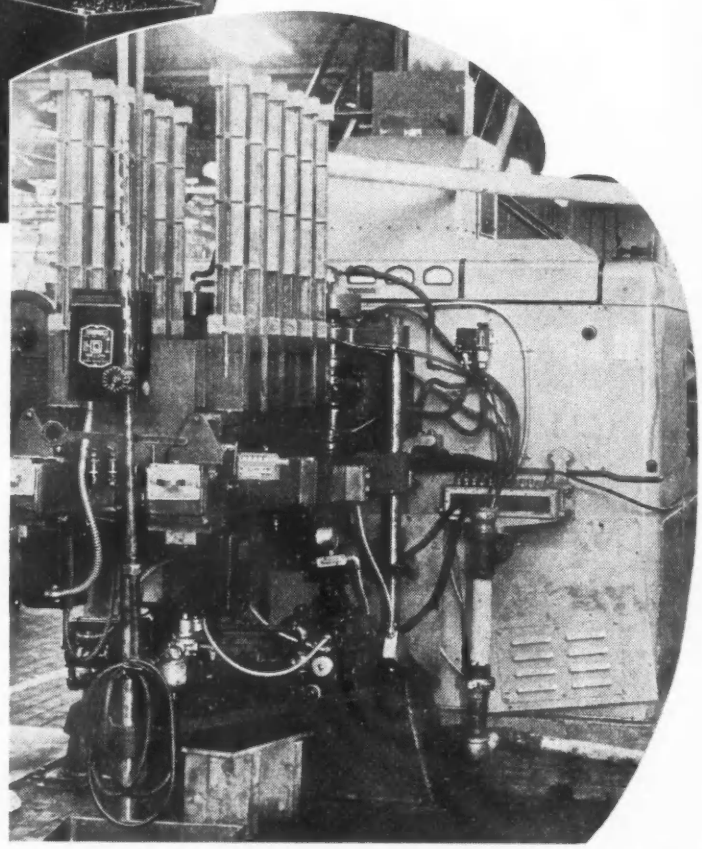
* On August 4, 1948, at the instigation of President Truman, a bill was introduced in the special session of Congress to reimpose a tax on "excess profits" to yield $4.3 billions yearly—Editor.

Auto-Lite's

By Joseph Geschelin



This is a close-up of the new DeVilbiss automatic spraying and drying unit. Coils are fitted onto the revolving spindles mounted on the rotary table, moving through the automatic spray station at the right and the drying oven at the left with no operator attention except to load and unload.



By means of the special magazine feed attachment shown at the left, a big two-station Tocco machine has been converted into a high production induction brazing unit for making up centrifugal weight assemblies.

IN REORGANIZING its manufacturing facilities after the war, the Electric Auto-Lite Co. centralized the making of ignition coils, distributors, and condensers in a new plant in Toledo, Ohio, known during the war as its Aviation Division.

Although coils and distributors are made in enormous volume, the operation has some of the aspects of a glorified job-shop owing to the many variations from any standard product specified by a large number of customers. Some impression of this may be gained from the fact that about 100 types of coils, and over 800 variations of distributors are produced during the course of a year.

To achieve smooth flow and maximum economy the plant has been organized into departments feeding the principal assembly areas. Coil assembly and distributor assembly have been centralized at one end of the plant. Condenser fabrication is housed in a separate section of the building to afford an enclosed and isolated air-conditioned department.

From the standpoint of the consumer one of the major features of the coil department is the large test bank on which all coils are tested for 45 minutes after leaving the assembly department. Following this each coil is subjected to a high voltage test for possible break-down. Only coils passing this schedule are considered suitable for shipment to the customer. Another interesting feature is the new De Vilbiss unit for painting and drying coils. As illustrated, this unit has a large circular indexing table fitted with rotating spindles on which the coils are mounted. At one station there is a bank of automatic spray guns arranged to cover the entire area of the coil as the spindles move through. Leaving the spray station the work enters an enclosed drying oven of circular form with an arc of sufficient length to completely dry the work during a revolution of the table.

Distributor assembly requires a multiplicity of small sub-assemblies which are finally integrated in a number of stages along the final assembly line.

Flexible Setup

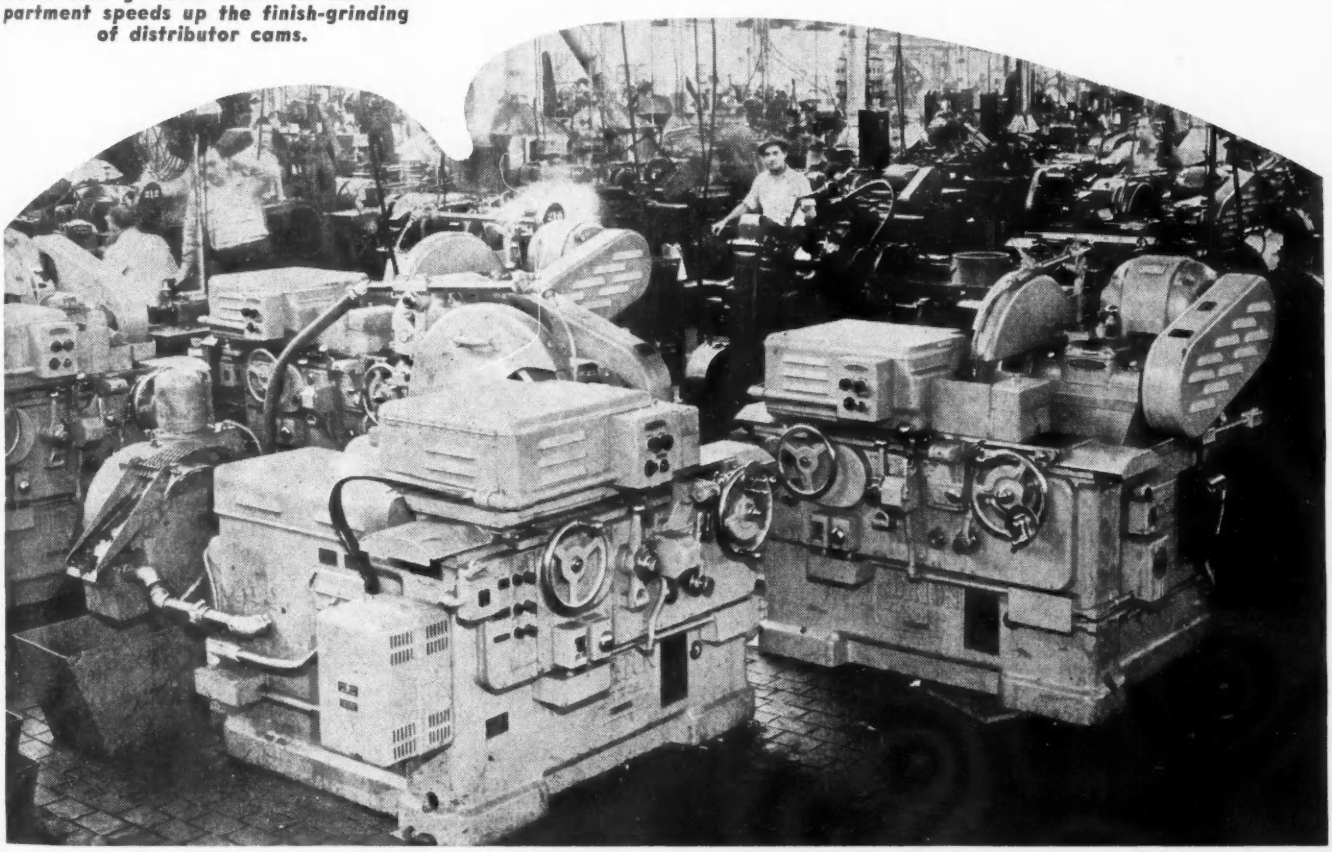
More than 800 Variations of Distributors and About 100 Types of Ignition Coils Produced at Toledo Plant

The latter stages are handled on "wheels" holding a large number of units at a time. Since the fixture has numerous work-holding stations arranged in bands around the periphery, it is possible to mount a number of different types of parts on the same fixture simply by inserting them into the proper bands.

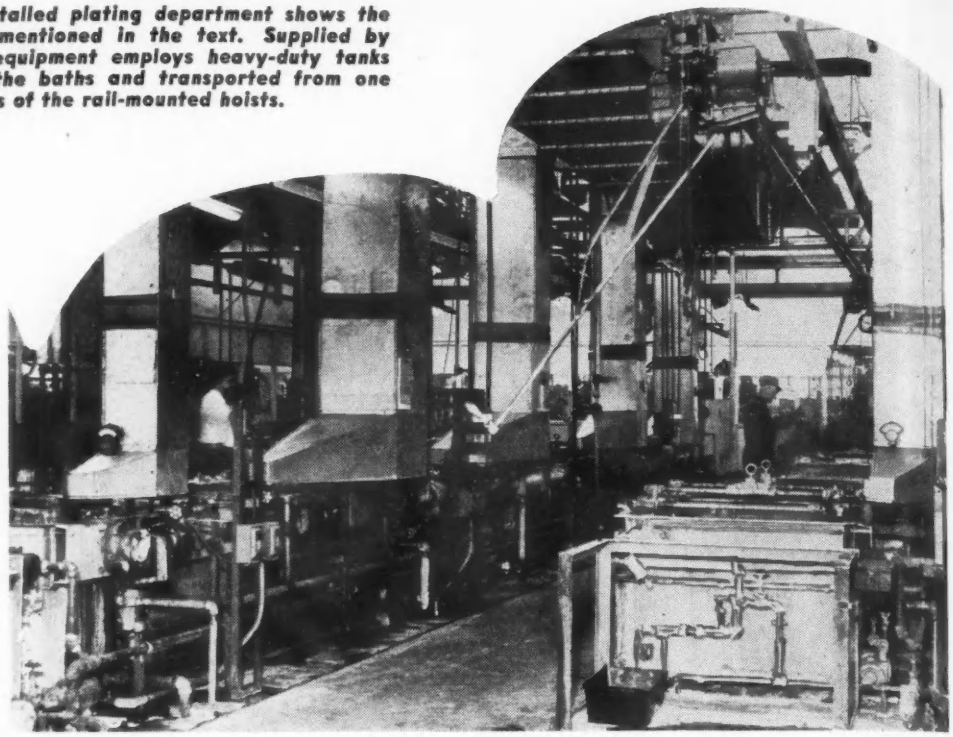
The observer will find that this plant is singularly free from the usual conveyors and power driven materials-handling devices. This is explained by the fact that since the product requires a multiplicity of extremely small sub-assemblies, the flow of operations is best facilitated by compactness and close proximity of one operation to another. Such an arrangement makes it feasible to move work from station to station without mechanical means. Inter-departmental movement of work is handled by means of the familiar Clark industrial trucks.

The machine shop is entirely departmentalized. Here is an extensive screw machine group comprising a battery of some 57 New Britain-Gridley automatics, and a cast-iron machine shop having a battery of six-spindle New Britain-Gridley chucking machines. The latter all use cemented-carbide tooling. The automatic screw machines are arranged about a central aisle which houses a mechanized chip conveyor below floor level. Each machine is arranged to dump its chips onto the conveyor through a chute. The chip conveyor, in turn, transports the load to a small reclaiming department where chips are centrifuged to remove cutting fluid. The centrifuged cutting fluid

A battery of four new Norton automatic cam grinders added in this department speeds up the finish-grinding of distributor cams.



Perspective view of the newly installed plating department shows the two main lines of plating tanks mentioned in the text. Supplied by Hanson-Van Winkle-Munning, the equipment employs heavy-duty tanks which are moved in and out of the baths and transported from one end to the other by means of the rail-mounted hoists.



then is collected, sterilized, and returned to storage for re-use.

One of the most interesting pieces of equipment in this area is a specially tooled Brown & Sharpe cylindrical grinder fitted with a mechanism for automatic loading and unloading for grinding small Oilite distributor bushings automatically. This converts a small standard machine into the equivalent of a special machine of immense productivity. The machine is provided with a dial loading device which feeds bushings to the arbor through a chute. At the loading station the bushing is pushed into the work area where it is picked up by the arbor. The grind is made rapidly and the work ejected automatically into a curved chute reaching to the front of the apron of the machine. It requires no attention except for loading the dial magazine.

Since this plant requires a considerable variety of small stampings and laminations it has a well organized press shop, arranged in two separate sections—one exclusively for blanking operations; the other for secondary operations and forming.

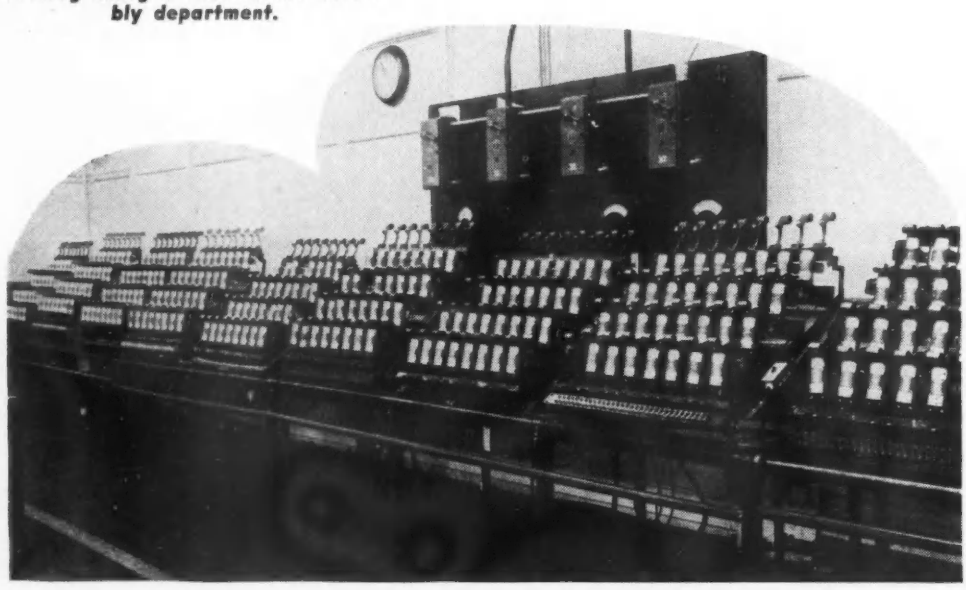
While on the subject of stampings, the set-up for making the distributor centrifugal weight assemblies is quite distinctive. Centrifugal weights are made up of six individual laminations which are blanked in a high speed Henry & Wright dieing machine. Conventional practice has been to stack the laminations and then rivet them together. Auto-Lite makes the assembly by induction brazing instead. For this purpose the blanks are washed and copper plated, then routed to a large Tocco induction heating unit. The accessory equipment that has been developed by Auto-Lite makes the operation noteworthy, as the Tocco unit is a standard piece of equipment.

As illustrated, the Tocco machine is fitted with a special device consisting of two banks of six vertical magazines. Each magazine holds a specific type of blank, the magazines being arranged in order of assembly. The use of two banks makes possible the brazing of two weights at a time. On each side of the machine is a sorting device into which blanks are dumped, the function of this device being to stack laminations in proper position. From the sorting device the blanks are loaded into the magazines.

Each side of the fix-

(*Cont'd on page* 88)

Production testing of ignition coils is done in this big unit extending along a wall in the assembly department.



Current Passenger Car Price, Weight and Body Table

Following are prices at factory for cars with standard equipment as of August 7. State or local taxes, transportation and finance charges and optional equipment are extra.

BODY, MAKE AND MODEL	List Price at Factory without Federal Taxes	Federal Taxes and Handling Charges	Delivered Price at Factory including Federal Taxes	Shipping Weight
BUICK				
Series 40				
Sedanet, 2d.	1615	120	1735	3635
Touring Sedan, 4d.	1685	124	1809	3705
Series 50				
Sedanet, 2d.	1845	142	1987	3770
Touring Sedan, 4d.	1940	147	2087	3855
Convertible Coupe	2350	168	2518	4020
Estate Wagon	2925	199	3124	4170
Series 70				
Sedanet, 2d.	2125	172	2297	4065
Touring Sedan, 4d.	2240	178	2418	4160
Convertible Coupe	2638	199	2837	4315
Estate Wagon	3205	228	3433	4460
CADILLAC				
Series 61				
Club Coupe, 2d.	2565	163	2728	4090
Touring Sedan, 4d.	2665	168	2833	4175
Series 62				
Club Coupe, 2d.	2735	177	2912	4120
Touring Sedan, 4d.	2815	181	2996	4205
Convertible Coupe, 2d.	3240	202	3442	.....
Series 60				
Touring Sedan, 4d.	3590	230	3820	.....
Series 75				
Business Sedan	4395	284	4679	.....
Touring Sedan, 4d.	4490	289	4779	4890
Business Imperial	4575	293	4868	4945
Sedan, 4d., 7p.	4700	299	4999	4910
CHEVROLET				
Stylemaster				
Business Coupe	1160	84	1244	3045
Town Sedan, 2d.	1225	88	1313	3095
Sport Coupe	1235	88	1323	3020
Sport Sedan, 4d.	1280	91	1371	3115
Fleetmaster				
Town Sedan, 2d.	1290	91	1381	3110
Sport Coupe	1310	92	1402	3050
Sport Sedan, 4d.	1345	94	1439	3150
Cabriolet	1640	110	1750	3340
Station Wagon	1890	123	2013	3405
Fleetline				
Aerosedan, 2d.	1340	94	1434	3100
Sportmaster, 4d.	1395	97	1492	3150
CHRYSLER				
Royal-Six				
Coupe, 2d., 3p.	1723	96	1819	3395
Lux. Brougham	1808	100	1908	3485
Club Coupe	1833	101	1934	3475
Sedan, 4d., 6p.	1853	102	1955	3523
Sedan, 8p.	2255	125	2380	3925
Limousine, 4d. 8p.	2375	131	2506	4022
Windsor-Six				
Coupe, 2d., 3p.	1785	99	1884	3395
Lux. Brougham	1885	104	1989	3510
Club Coupe	1895	105	2000	3475
Sedan, 4d., 6p.	1915	106	2021	3528
Traveler Sedan	2050	113	2163	3610
Convertible Coupe	2289	125	2414	3693
Sedan, 4d., 8p.	2307	127	2434	3935
Limousine	2427	134	2561	4035
Saratoga-Eight				
Coupe, 2d., 3p.	2052	113	2165	3817
Lux. Brougham	2137	117	2254	3900
Club Coupe	2147	118	2265	3930
Sedan, 4d., 6p.	2172	119	2291	3972
New Yorker-Eight				
Coupe, 2d., 3p.	2166	119	2285	3837
Lux. Brougham	2251	123	2374	3932
Club Coupe	2261	124	2285	3940
Sedan, 4d., 6p.	2286	125	2411	3987
Convertible Coupe	2670	145	2815	4132
Town and Country-Eight				
Convertible Coupe	3221	174	3395	4332
Crown Imperial-Eight				
Sedan, 8p.	4428	234	4662	4865
Limousine	4528	239	4767	4875
CROSLEY				
Sedan, 2d.	888	.....	.....	1115
Convertible	949	.....	.....	1110
DE SOTO				
De Luxe				
Coupe, 2d., 3p.	1610	89	1699	3285
Sedan, 2d.	1695	93	1788	3375
Club Coupe	1720	95	1815	3385
Sedan, 4d.	1730	95	1825	3435
Custom				
Brougham	1763	97	1860	3399
Club Coupe	1776	98	1874	3389
Sedan, 4d., 6p.	1793	99	1892	3439
Convertible Coupe	2177	119	2296	3599
Sedan, 4d., 7p.	2195	120	2315	3819
Limousine, 7p.	2315	127	2442	3995
Suburban	2495	136	2631	3974
DODGE				
DeLuxe				
Coupe	1503	84	1587	3146
Sedan, 2d.	1588	88	1676	3236
Sedan, 4d.	1628	90	1718	3256
Custom				
Club Coupe	1681	93	1774	3241
Sedan, 4d.	1694	94	1788	3281
Town Sedan	1774	98	1872	3331
Sedan, 7p.	2065	114	2179	3757
Convertible Coupe	2075	114	2189	.....
FORD				
Six				
Business Coupe	1158	94	1252	2876
Tudor	1308	102	1410	2957
Club Coupe	1328	104	1432	2910
Fordor	1368	106	1474	3012
Custom Six				
Tudor	1415	108	1523	2957
Club Coupe	1435	109	1544	2910
Fordor	1480	112	1592	3012
Convertible Coupe	1759	127	1886	.....
Station Wagon	1980	139	2119	3518
Eight				
Business Coupe	1330	.04	1434	2925
Tudor	1390	107	1497	3006
Club Coupe	1430	109	1539	2960
Fordor	1450	110	1560	3061
Custom Eight				
Tudor	1490	112	1602	3006
Club Coupe	1515	114	1629	2960
Fordor	1550	116	1666	3061
Convertible Coupe	1835	131	1966	.....
Station Wagon	2118	147	2265	3567
FRAZER				
Sedan, 4d.	2321	162	2483	3375
Manhattan, 4d.	2573	173	2746	3375
HUDSON				
Super Six				
Coupe, 3p.	1855	132	1987	3460
Brougham	1940	137	2077	3470
Club Coupe	1985	139	2124	3480
Sedan	1988	139	2127	3500
Commodore Six				
Club Coupe	2130	147	2277	3550
Sedan	2153	148	2301	3540
Super Eight				
Club Coupe	2090	150	2240	3495
Sedan	2093	150	2243	3525
Commodore Eight				
Club Coupe	2230	157	2387	3570
Sedan	2253	158	2411	3600
KAISER				
Sedan, 4d.	2091	153	2244	3302
Custom Sedan, 4d.	2301	165	2466	.....
LINCOLN				
Coupe, 6p.	2450	183	2633	3990
Sport Sedan, 4d.	2495	186	2681	4060
Convertible, 6p.	2910	207	3117	4330
Cosmopolitan				
Coupe, 6p.	3075	217	3292	4275
Town Sedan, 4d.	3125	219	3344	4315
Sport Sedan, 4d.	3125	219	3344	4420
Convert ble, 6p.	3800	254	4054	4505
MERCURY				
Coupe, 6p.	1945	140	2085	3375
Sport Sedan, 4d.	1975	141	2116	3430
Convertible, 6p.	2375	162	2537	3699
Station Wagon	2645	176	2821	3758
NASH				
600-DeLuxe				
Business Coupe, 2d.	1373	105	1478	2635
600-Super				
Brougham	1433	105	1538	2731
Sedan, Trunk; 4d.	1482	105	1587	2786
Slipstream Sedan, 4d.	1438	105	1543	2826
600-Custom				
Brougham, 2d.	1613	114	1727	2731
Slipstream Sedan, 4d.	1618	114	1732	2826
Sedan, Trunk; 4d.	1662	114	1776	2786
Ambassador-Super				
Brougham, 2d.	1733	125	1858	3312
Slipstream Sedan, 4d.	1749	125	1874	3412
Sedan, Trunk; 4d.	1791	125	1916	3387
Ambassador-Custom				
Brougham, 2d.	1913	134	2047	3312
Slipstream Sedan, 4d.	1929	134	2063	3412
Sedan, Trunk; 4d.	1971	134	2105	3387
Cabriolet	2198	147	2345	3465
OLDSMOBILE				
Series 66 (Six)				
Club Coupe	1500	109	1609	3240
Club Sedan	1525	109	1634	3285
Sedan, 4d.	1565	112	1677	3320
Club Coupe, DeLuxe	1635	114	1749	3255
Club Sedan, Deluxe	1660	116	1776	3300
Sedan, DeLuxe, 4d.	1700	118	1818	3335
Station Wagon	2455	159	2614	3620
Series 76 (Six)				
Club Sedan	1610	116	1726	3425
Sedan, 4d.	1680	121	1801	3500
Club Sedan, DeLuxe	1750	123	1873	3445
Sedan, 4d., DeLuxe	1820	127	1947	3535
Series 68 (Eight)				
Club Coupe	1555	112	1667	3355
Club Sedan	1580	113	1693	3420
Sedan, 4d.	1620	115	1735	3445
Club Coupe, DeLuxe	1690	118	1808	3370
Club Sedan, DeLuxe	1715	119	1834	3435
Sedan, 4d., DeLuxe	1755	121	1876	3460
Convertible Coupe	1930	131	2061	3660
Station Wagon	2510	162	2672	3770
Series 78 (Eight)				
Club Sedan	1665	120	1785	3545
Sedan, 4d.	1735	124	1859	3625
Club Sedan, DeLuxe	1805	126	1931	3590
Sedan, 4d., DeLuxe	1875	130	:005	3665
OLDSMOBILE (Continued)				
Series 98 (Eight)				
Club Sedan	1940	138	2078	3645
Sedan, 4d.	2010	141	2151	3705
Club Sedan, DeLuxe	2040	142	2182	3685
Sedan, 4d., DeLuxe	2110	146	2256	3745
PACKARD				
Eight-2201				
Club Sedan	2117	133	2250	3755
Touring Sedan	2140	135	2275	3815
Station Sedan	3232	193	3425	4075
DeLuxe Eight-2211				
Club Sedan	2370	147	2517	3770
Touring Sedan	2395	148	2543	3840
Super Eight-2202				
Club Sedan	2635	167	2802	3790
Touring Sedan	2659	168	2827	3855
Super Eight-2222				
Touring Sedan	3299	201	3500	4460
Limousine	3442	208	3650	4525
Touring Sedan, DeLuxe	3632	218	3850	4590
Limousine, DeLuxe	3774	226	4000	4610
Super Eight-2232				
Conv. Victoria Coupe	3061	189	3250	4025
Custom Eight-2206				
Club Sedan	3484	216	3700	4110
Touring Sedan	3532	218	3750	4175
Custom Eight-2226				
Touring Sedan	4440	264	4704	4860
Limousine	4596	272	4868	4880
Custom Eight-2233				
Conv. Victoria Coupe	4051	244	4295	4380
PLYMOUTH				
DeLuxe				
Coupe, 3p.	1272	74	1346	2977
Sedan, 2d.	1307	76	1383	3047
Club Coupe	1332	77	1409	3037
Sedan, 4d.	1362	79	1441	3082
Special DeLuxe				
Coupe, 3p.	1362	78	1440	2982
Sedan, 2d.	1392	79	1471	3062
Club Coupe	1422	81	1503	3057
Sedan, 4d.	1447	82	1529	3107
Convertible Coupe	1758	99	1857	3282
Station Wagon	1958	110	2068	.....
PONTIAC				
Torpedo Six				
Business Coupe	1397	103	1500	3230
Sport Coupe	1446	106	1552	3220
Sedan, 2d.	1475	108	1583	3280
Sedan Coupe	1505	109	1614	3275
Sport Coupe, DeLuxe	1531	110	1641	3230
Sedan, 4d.	1531	110	1641	3320
Sedan Coupe, DeLuxe	1590	114	1704	3275
Sedan, 4d., DeLuxe	1616	115	1731	3340
Conv. Sedan Coupe, DeLuxe	1895	130	2025	3525
Streamliner Six				
Sedan Coupe	1564	113	1677	3365
Sedan, 4d.	1612	115	1727	3450
Sedan Coupe, DeLuxe	1649	117	1766	3370
Sedan, 4d., DeLuxe	1697	120	1817	3455
Station Wagon	2217	147	2364	3755
Station Wagon, DeLuxe	2291	151	2442	3695
Torpedo Eight				
Business Coupe	1442	106	1548	3295
Sport Coupe	1491	108	1599	3295
Sedan, 2d.	1520	110	1630	3360
Sedan Coupe	1550	111	1661	3340
Sport Coupe, DeLuxe	1576	113	1689	3305
Sedan, 4d.	1576	113	1689	3395
Sedan Coupe, DeLuxe	1635	116	1751	3340
Sedan, 4d., DeLuxe	1661	117	1778	3395
Conv. Sedan Coupe, DeLuxe	1940	132	2072	3600
Streamliner Eight				
Sedan Coupe	1609	115	1724	3425
Sedan, 4d.	1657	118	1775	3525
Sedan Coupe, DeLuxe	1694	120	1814	3455
Sedan, 4d., DeLuxe	1742	122	1864	3530
Station Wagon	2262	150	2412	3820
Station Wagon, DeLuxe	2336	154	2490	3765
STUDEBAKER				
Champion DeLuxe				
Coupe, 3p.	1432	103	1535	2590
Sedan, 2d.	1497	107	1604	2675
Coupe, 5p.	1522	108	1630	2670
Sedan, 4d.	1527	109	1636	2720
Champ. Regal DeLuxe				
Coupe, 3p.	1502	107	1609	2615
Sedan, 2d	1567	111	1678	2685
Coupe, 5p.	1592	112	1704	2690
Sedan, 4d.	1597	112	1709	2725
Convertible	1930	130	2060	2865
Commander				
Coupe, 3p.	1732	124	1856	.....
Sedan, 2d.	1797	128	1925	3165
Coupe, 5p.	1822	129	1951	3150
Sedan, 4d.	1827	129	1956	3195
Comm. Regal DeLuxe				
Coupe, 3p.	1847	131	1978	.....
Sedan, 2d.	1912	134	2046	3175
Cpupe, 5p.	1937	135	2072	3165
Sedan, 4d.	1942	136	2078	3215
Land Cruiser	2120	145	2265	3280
Convertible	2278	153	2431	3385
WILLYS				
Station Wagon (463)	1645	91	1736	2995
Jeepster	1765	95	1860	2387
Station Wagon (663)	1890	104	1994	2968

THE first extensive model change made by Kaiser-Frazer Corp., since the initial introduction of its line of four-door cars is announced with the entry of 1949 Kaiser Special and DeLuxe sedans which are now in full production and being shipped to dealers.

Major features of the new line may be summarized as follows:

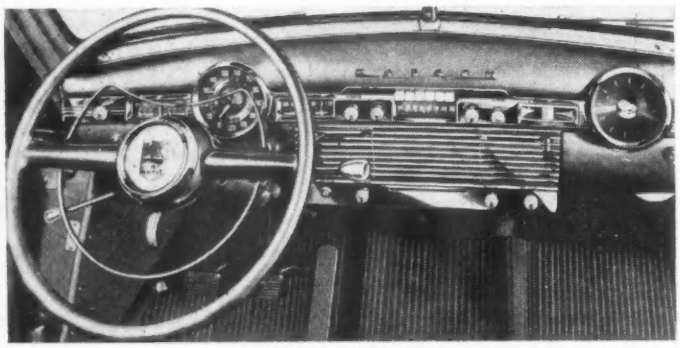
1. Increase from 100 to 112 hp in the Kaiser DeLuxe six-cylinder engine with no loss in fuel economy, and without increase in displacement or compression ratio.
2. Improved clutch, steering, and brake mechanism, including the elimination of 52 parts in the clutch linkage.
3. Redesigned body styling including new bumpers, front and rear fenders, hood, lower body side panels, and grille. Overall height remains at 64½ in. while overall length has been increased to 206½ in.
4. Completely restyled interiors with new instrument panels.

The new sheet metal treatment with lower-skirted fenders and lower chrome trimmed rocker panels—which are integral with the body—is said to create the appearance of a lower silhouette. The grille has horizontal bars and in combination with a massive wrap-around front bumper provides an entirely new front end appearance for the Kaiser line. The grille also includes large parking lamps and a new emblem.

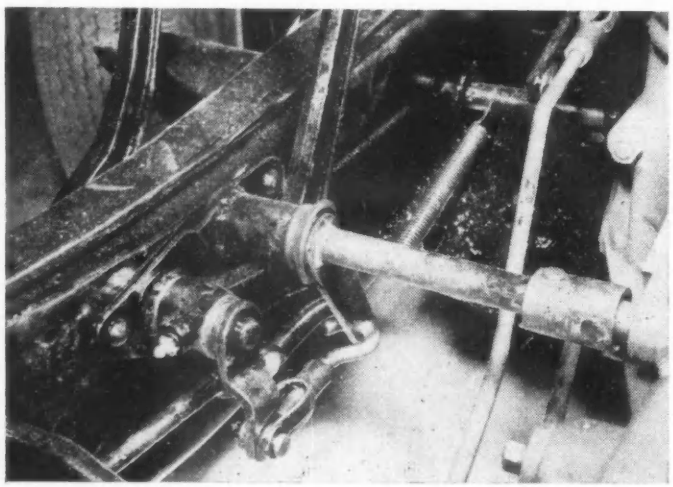
Interesting interior feature is the introduction of chrome-plated assist handles to provide finger leverage for thumb operation of the push-button door controls; and a sliding latch on the face of the upholstery panel, replacing the conventional plunger type door molding lock.

Greater horsepower without loss in operating economy are among the results said to be attained from 15 improvements in the power

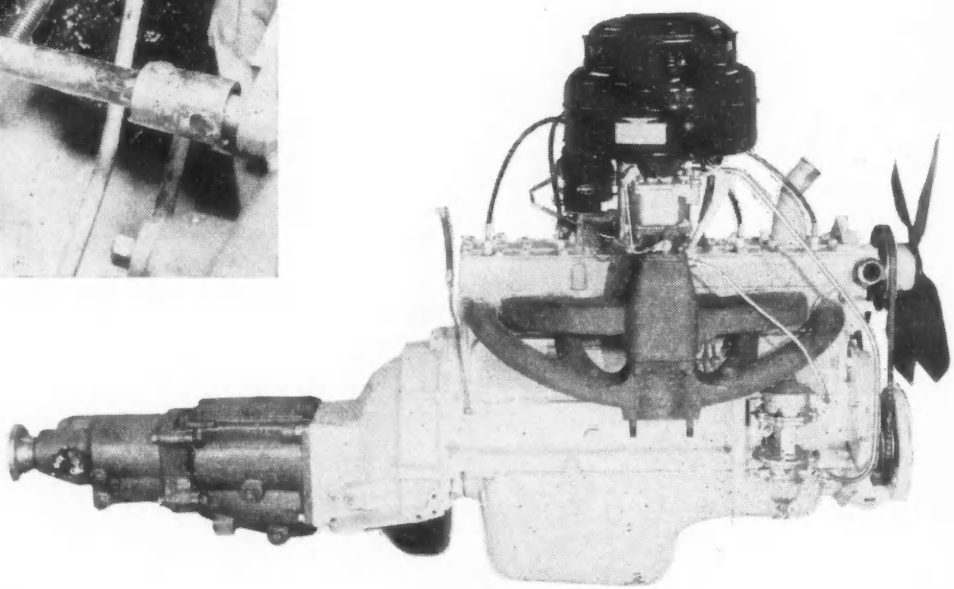
1949



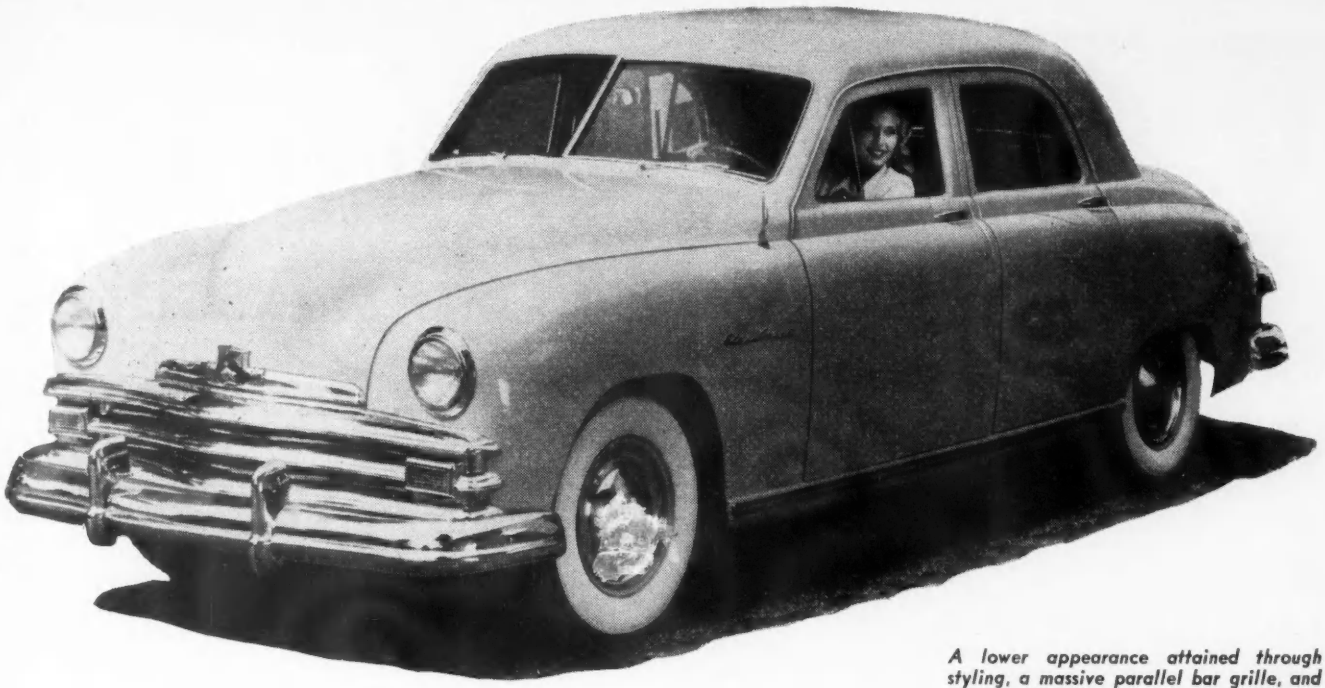
Entirely redesigned, the 1949 Kaiser DeLuxe instrument panel incorporates edge-illuminated plastic numeral rings on all instruments. Instrument panel and radio panel lighting may be reduced by a rheostat control.



Close-up of the new clutch linkage which has fewer parts and weighs 50 per cent less than the standard linkage used on former models.



New manifolding and a dual throat carburetor add 12 per cent to the power of the Kaiser DeLuxe six-cyl. engine.



A lower appearance attained through styling, a massive parallel bar grille, and new standard height, wrap-around bumpers are features of the 1949 Kaiser models.

Kaiser Models

Introduce First Major Changes

Horsepower Increase from 100 to 112 and New Body Styling Are Among Important Improvements

plant of the 1949 Kaiser DeLuxe sedan. A dual throat carburetor and dual manifold system have increased output to 112 hp as compared with 100 hp on previous models. The 12 per cent gain in power is said to be accomplished without increase in fuel consumption.

The dual throat carburetor is said to provide free flow of a balanced mixture of fuel and air to all cylinders. Each throat acts as a single carburetor and provides the fuel mixture to its own half of the manifold, supplying three cylinders. Other features and changes in the engine have been applied to the Kaiser Special, as well as to the Kaiser DeLuxe model.

Better absorption of engine vibration has been achieved by mounting the engine at three points on resilient live rubber blocks, the rear mounting being on a newly designed cross member.

Redesign and simplification of the accelerator linkage is responsible for feather touch control of the throttle. However, pedal pressure can be adjusted to suit the owner's preference.

Cooling fins in the radiator have been completely shrouded, resulting in a nine per cent increase in cooling efficiency as well as providing better air flow. A new side-mounting of the radiator eliminates tie rods and assures ready access to the engine.

Engine splash shields, with removable covers for quick motor accessibility, have been enlarged and protect the engine from "drowning" out when driving through water.

Other changes include a more compact oil bath cleaner, improved tappets for easier adjustment, improved crankcase ventilation, new muffler and exhaust pipes, and new location of the fuel line to eliminate the possibility of vapor lock due to manifold heat.

The Kaiser models also have the benefit of some 15 chassis changes. Refinement in steering has been made by redesigning the pitman arm, thus reducing the turning circle to 40 ft. A constantly decreasing brake pedal ratio has been incorporated to provide controllable braking action. This provides a high initial ratio for normal traffic stops with a soft yielding pedal, and a low final ratio for hard emergency braking. Pedal pressure has been decreased by 18 per cent.

Riding quality has been improved by the use of longer front coil springs and an improved rear leaf spring suspension. A linkless front stabilizer bar is another new feature.

(Turn to page 76, please)

Integrated Assures

To assure long life and resistance to fatigue, certain parts subject to high stress are given a shot-peening treatment in the Pangborn Rotoblast machine.

WHEN the Chevrolet-Toledo Division, General Motors Corp., completed its changeover for producing the heavy duty synchromesh transmission for 1948 Chevrolet trucks, it accomplished more than is usually implied in a new plant layout and a large investment in new machinery. What is not so evident on the surface is the change in manufacturing philosophy expressed in an integrated chain

This four-head Rehnberg-Jacobson special machine is designed to drill and tap two, 1/4x20 holes in the floor of the case. The first two heads drill, the second pair taps.

Budd Electronic heaters are used for certain jobs requiring selective hardening. The unit in this view hardens the tips of gearshift forks.

Second speed synchronizer ring—a part having two projecting lugs—has the lugs ground, one at a time, in this Norton angular head grinder.

Chain of Quality Controls Better Truck Transmissions

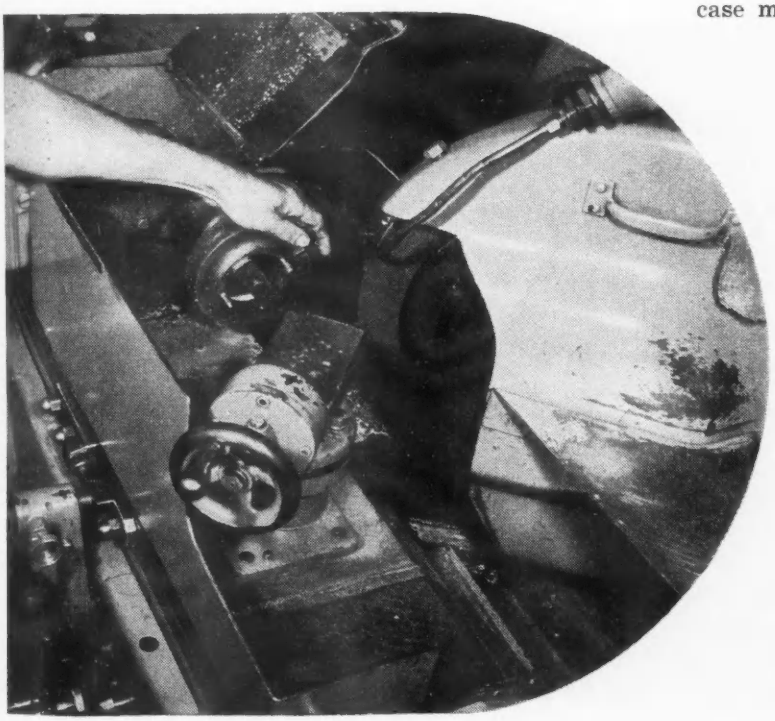
Production Changeover at Chevrolet-Toledo Plant Also Includes Selective Fitting of Parts and Unique Lapping Operations on Improvised Machines

By Joseph Geschelin

of quality controls starting with the raw material, progressing through each stage of production and sub-assembly, and culminating in final proof-testing of all assembled transmissions. Of more than passing interest is the statement that the changeover—with all its complication—was effected without interrupting production.

Since the synchromesh transmission is intended to make things easy for the truck driver, every detail of the operation is directed at producing an easy-to-shift gear box as quiet as any good passenger car transmission. As will be described later, the combination of quality controls, selective fitting of parts, and some unique lapping operations on improvised machines is said to give results comparable with costly gear and spline grinding methods.

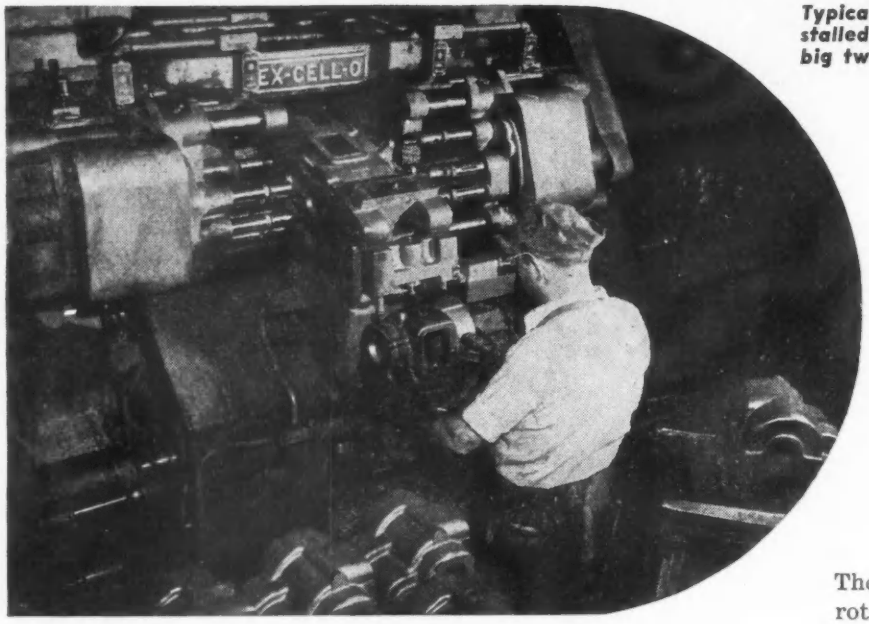
Gears and shafts are produced by conventional methods, using Barber-Colman hobbing machines and multiple-spindle hobbers of advanced type for all gears except shoulder gears. Fellows gear shapers are employed on the difficult jobs where the interference of shoulders or cluster gears makes gear shaping indispensable. All gears, however, are shaved in the green on an enormous battery of the familiar Red Ring shavers.



Quality control begins with the machining of individual gears and shafts, all parts being inspected to assure dimensional accuracy. The gear laboratory is the center of control of the gear department. In the first place, each time a cutter is replaced the first piece of the set-up is completely inspected for gear tooth profile, tooth spacing, lead and helix as the case may be. The initial runs on each gear shaver also are tested in the Red Ring gear speeder for noise. At least once an hour a sample gear is taken from each machine and put through the laboratory.

The foregoing refers only to gears in the "green". The work then goes to the heat treating department where gears and shafts are pack-carburized, re-heated and quenched in a formal sequence of operations subject to close control. From here the routing leads into the grinding department. All ground parts are subject to 100 per cent inspection to assure dimensional accuracy as well as visual examination of surface quality.

So far quality control has guarded and screened parts in the green and in the hard. The assembly stages are subject to an even more exacting procedure. Despite the precautions taken in the making of component parts, the overall tolerances on sub-assemblies are held so closely that selective fitting of major



Typical of the large production machines installed on the transmission case line is this big two-way Ex-Cell-O. The trunnion fixture holds eight cases.

parts is imperative if stack-up of tolerances is to be avoided. In assembling synchronizer units, not only are parts selected to fit but each unit is machine lapped to assure easy operation. Similar precautions are taken in making up mainshaft and countershaft sub-assemblies—selective fitting and machine lapping where sliding fits are required. In addition, the mainshaft and countershaft sub-assemblies are run together in selected pairs in the Red Ring speeder to assure quietness before they are assembled in the case.

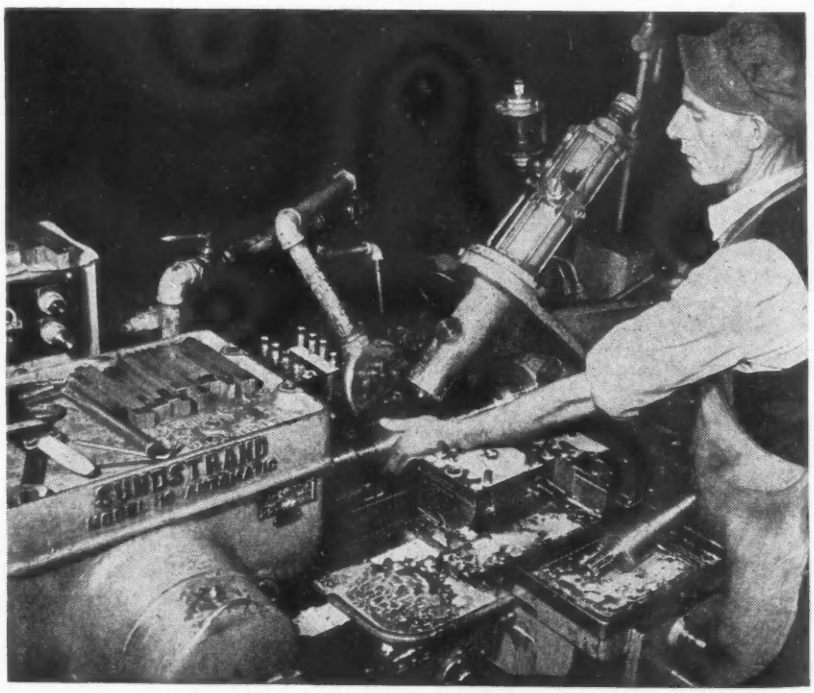
By this time the parts are ready for final assembly and everything that is humanly possible has been done to assure a good gear box. Nevertheless, each transmission must pass a final consumer acceptance test in the sound room. As the gear boxes come off the assembly line they lead into the sound room where four seasoned inspectors handle the output. Each unit is tested at speed for drive and coast in each gear, including reverse, and the inspector will not hesitate to reject one that does not suit his trained ear, although the number that fails to pass muster is negligible.

From the manufacturing standpoint Chevrolet-Toledo is a large plant designed along the latest mass production lines. Since a point-by-point description would be out of the question in an article of this kind, we have selected a few examples of practice here and there as a means of highspotting advanced techniques that indicate the general character of the operation.

A problem of unusual difficulty was encountered in tooling the second speed synchronizer ring. This part has two ears or lugs projecting from the end and these lugs must be finish-ground to a section of a truncated cone. The operation is handled in a Norton angular wheelhead grinder as illustrated. The work is held in a fixture arranged to rotate in such fashion that one ear is ground as it is revolved in a circle of the specified diameter. When the operation has been completed, the fixture is indexed 180 deg so as to present the other lug to the grinding wheel.

Something interesting was added to the familiar Sundstrand Model 10 automatic lathe used for turning mainshafts. These have an undercut shoulder which ordinarily would require a second operation or some special attachment. In this case the attachment is an inclined, overhead, pneumatically operated head which may be seen in the center of the machine. The head is fitted with an undercutting tool which comes into play at the proper time in the machining cycle.

Both the case and cover are machined in parallel lines of individual machines tooled to handle the various operations. It is (*Turn to page* 85, *please*)



Here is one of several Sundstrand automatic lathes used for turning mainshafts. They have been fitted with the inclined pneumatic attachment shown in the center for turning an undercut.

AIRBRIEFS

By ROBERT McLARREN

Jumping the Gun

Despite the fact that S 2644, HR 6501, the so-called "Prototype Bill" failed to pass the Senate during the special session, the Government is going right ahead as though it had and has already formed a committee within the Air Coordinating Committee to study the problem. The new group includes Grant Mason, assistant to the Assistant Secretary of Air Force; Charles Cary, Secretary of the Navy's office; Harold Jones, member of the Civil Aeronautics Board, and Ira Abbott, aerodynamicist of the National Advisory Committee for Aeronautics. The committee will form three subcommittees to study the following problems:

(1) The present and future passenger and cargo aircraft needs of the airlines, the armed services and other groups; (2) The technical requirements of such aircraft; and (3) Methods by which the Government can recover its expenditures in the projects. The new group has already met with Senator Owen Brewster (R., Me.), and Representative Carl Henshaw (R., Calif.), sponsors of the twin bills and is planning additional meetings between now and next January when the bill will again be taken up by the 81st Congress. The bill has already aroused strong industry opposition on its "nationalization" feature, which would give to one or two manufacturers contracts for new aircraft development and insure them production contracts in competition with other designs developed under a free enterprise system. Latest indication of this "socialzation" is the discussion of "target dates" for various designs, so familiar to those who have followed the British program since the war.

British Reorganize

British aviaton continues its meandering and sometimes devious ways with the latest—another reorganization of British Overseas Airways Corp. The airline s now divided into two main divisions instead of three, each near-autonomous in responsibility for financial and technical success of its activities. The Eastern Division will operate the African, Middle and Far Eastern routes while the Western Division will handle the Canadian and U. S. business of the airline. An earlier consideration to cancel the Boeing Stratocruiser order, as reported here last month, was not carried out and the six transports now on order will be placed on the New York-London route of the Western Division as rapidly as they are delivered. The six Lockheed Constellations now flying this route will continue in a BOAC effort to exploit this traffic potential to the fullest. The Canadair DC-4M2 order now stands at 22 aircraft, 15 of which are scheduled for delivery in the next 12 months. Payment for the aircraft will be made by a short-term deferment of British payments to Canada on a large, interest-free loan made in 1942. The dollars required for the purchase will be obtained by the sale of Canadian dollar securities owned by United Kingdom residents. But the quirk in this whole complex of international dollar peregrination is the fact that Canadair, builders of the DC-4M, is owned by the Electric Boat Co., New York!

Government Money Slow

Secretary of Defense Forrestal has revealed that of the $2,295,100,000 Congress appropriated for Air Force procurement last Spring, he has, so far, authorized the expenditure of only $1,-345,165,000 of which only $1,005,125,491 has been obligated by the Air Force. Actually, procurement to date has been merely the issuance of "letters of intent" with few if any of the major contracts signed. The industry is thus unable to include their new fiscal 1949 orders in their backlog figures to stockholders and underwriters. Actually, this slow Government money is old news to the aircraft industry, which has frequently begun deliveries on procurement under letters of intent without actual signed contracts. But so long as banks advance money against letters of intent, then so long will the industry start work well in advance of the formality of signed Government contracts.

Marshal Plan for Aircraft

The Economic Cooperation Administration, Government agency financing the Marshall Plan for European recovery, has assumed payment of $2,122,-500 due Douglas Aircraft Co., Inc., for four DC-6 transports of Swedish and Danish airlines. ECA feels that since the planes will fly trans-Atlantic routes, they will make a valuable contribution to the earning power of the two Scandinavian countries and, therefore, is underwriting the costs. Earlier, ECA had approved payment of $965,000 for aircraft spare parts purchased by Air France on the same theory that it was good for French earning power. Douglas stated several months ago that he had numerous orders from European countries for DC-6 transport planes that were being delayed by dollar shortages and indications are that ECA will follow this precedent in providing additional funds for such purchases. The unfortunate fact remains, however, that these trans-Atlantic routes are in direct competition with U. S. airlines.

Strike Report

The 41-day strike at Ryan Aeronautical Co., San Diego, Calif., was settled by a wage increase of 10¢ an hour against a UAW demand for 16¢. The strike settlement, however, forced Ryan to rehire the strikers in addition to non-union workers hired in the interim, thereby bringing Ryan employment up to 1900 instead of the 1600 at the beginning of the walkout. A threatened walkout at the Douglas El Segundo Division was averted by a company pay raise of 10¢ an hour although company-International Association of Machinists negotiations continue on a new contract. Similar negotiations are in progress with the IAM local representing the employes of the Santa Monica Division. Meanwhile, the Boeing Airplane Co. strike continues unsettled since the April 22 walkout of Aeronautical Mechanics Union workers. Boeing's offer of 15¢ an hour plus the right to retain workers hired during the strike continues unsatisfactory to the union.

Airline Overhaul

There seems little doubt that the current domestic airline industry is in for a thorough reanalysis both in its own house and in the Civil Aeronautics Board, which regulates its most minute business activity. With losses mounting in the face of ever-increasing traffic, assuredly something is wrong. The CAB and top airline industry executives have been meeting in Washington. In addition, President Truman has asked the Reconstruction Finance Corp. to make a study of the airline financial situation and to prepare recommendations for financing best suited to the immediate and future development of the nation's airline industry. Meanwhile, charges and countercharges continue to fly between the CAB and its sick house. CAB suggests that $10-$15,000,000 annually could be saved by dispensing with free meals aloft. United Air Lines President William Patterson says that UAL will continue to serve meals as a basic part of its passenger service. CAB suggests fare raises. American Airlines chairman C. R. Smith says that he will not raise his fares above his long-held 6¢ per mile, and he wants to cut that to 5¢ per mile some day. Many blame the Civil Aeronautics Act of 1938 and its authority to grant "need" payments to

(*Turn to page* 78, *please*)

Design Innovations in a

SEVERAL design innovations are incorporated in the small single-cylinder engine now being built by Reo Motors, Inc. for driving lawn mowers, and for a variety of other uses. Since a majority of applications of engines of this type require some speed reduction, the camshaft is used as the power output shaft thereby achieving a 2 to 1 reduction at no additional cost. To further simplify and thereby reduce the cost of the engine, the valves are actuated by a single cam operating two rockers hinged from a single pin which is pressed into the block directly above the camshaft. The basic data for this engine are as follows:

Displacement	5.5 cu. in
Bore and Stroke	2 in. by 1.75 in.
Max bhp	1.4 at 3600 rpm
Max torque	2.2 lb ft at 2000 rpm
Compression ratio	6 to 1

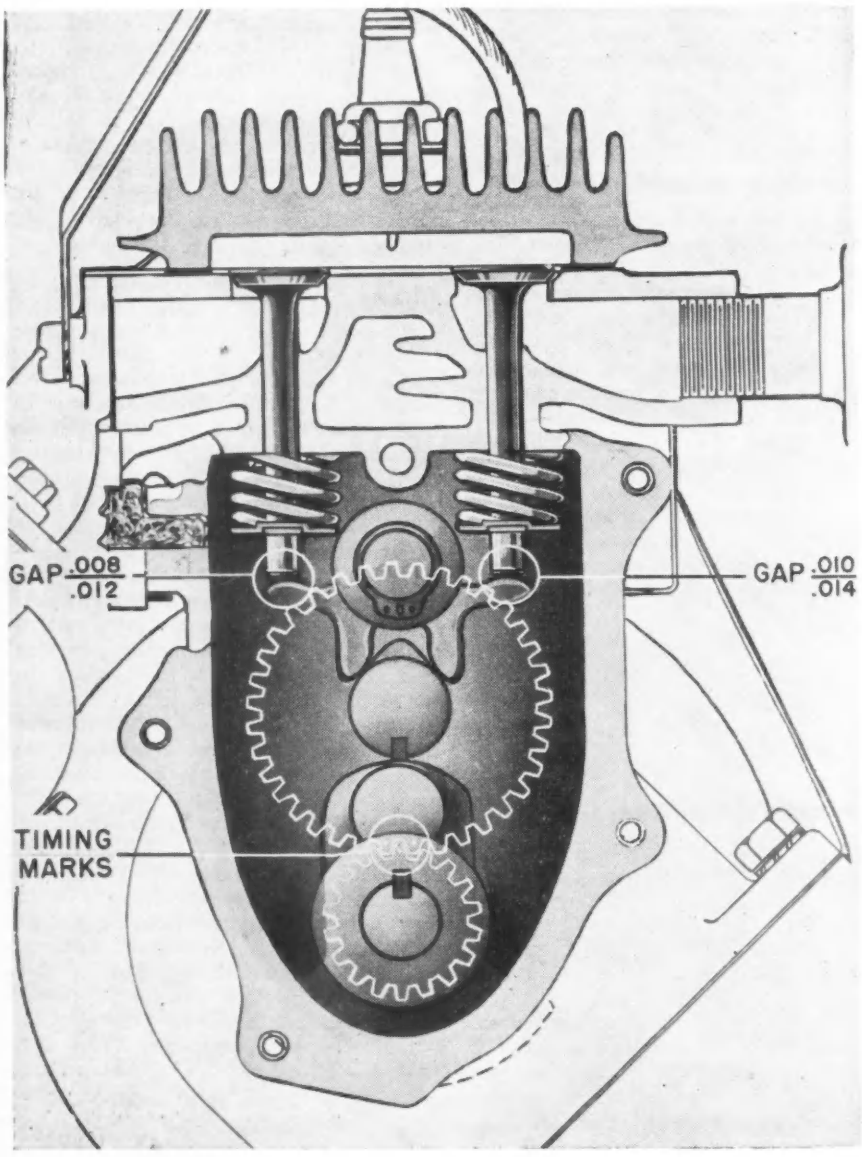
Induction hardened steel forgings are used for the crankshaft, camshaft and valve rockers. Steel spur gears are used as the camshaft drive. The cylinder head, connecting rod, base, magneto stator plate, and valve cover are aluminum die castings. The piston is a permanent mold aluminum alloy casting carrying two compression rings and one oil ring.

The aluminum die cast connecting rod runs directly on the induction hardened steel crank pin and carries a full floating piston pin at the small end.

The lubrication of all parts of the engine is accomplished by splash created by a cast dipper on the connecting rod cap. Automatic control is obtained throughout the engine speed range by the use of an adjustable air vane type governor.

Ignition is supplied by a high tension magneto incorporated in a fan type flywheel. The valves have a lift of 0.177 in. The exhaust valve is of 2112, austentic steel alloy. The carburetor is a hinged float type with idle adjustment only. Starting is by means of a rope and pulley.

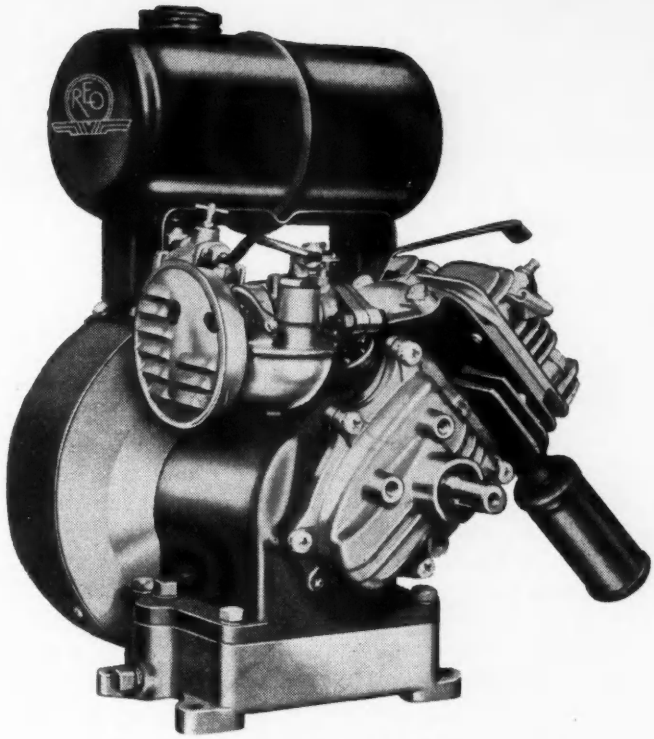
Future plans of the manufacturer include the production of models having a six to one reduction unit and a direct drive output shaft.



Sectional view showing valve mechanism.

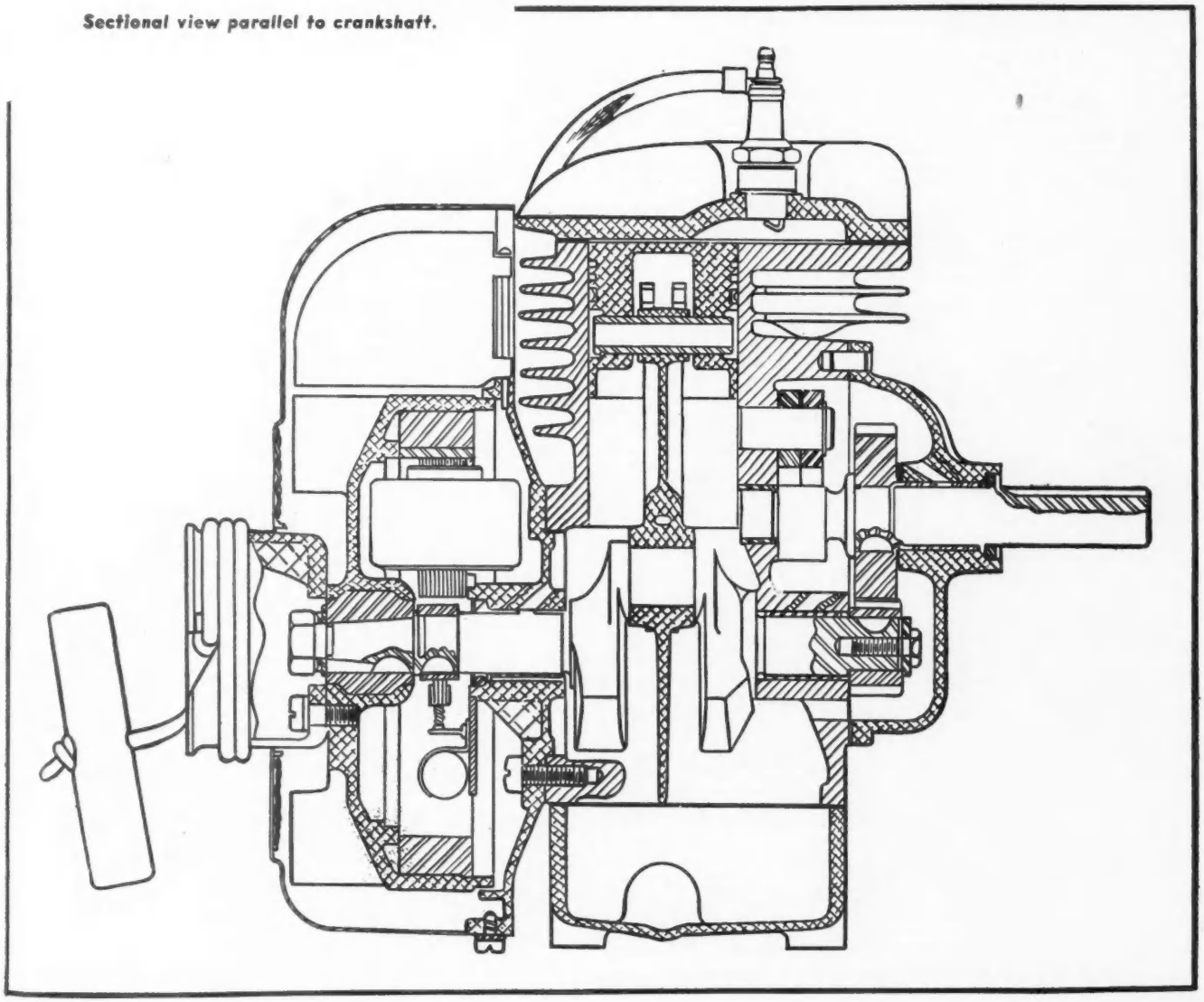
Small Engine

Employment of the Camshaft as Power Take-Off Shaft and Valve-Actuating Mechanism, Which Requires Only One Cam, Are Unusual Features of This New Power Plant



Reo LM 552 single-cylinder four-stroke engine.

Sectional view parallel to crankshaft.



Radial Engine Cam

By Glen D. Angle
Consulting Engineer

THE first part of this article dealt with the relative proportions of lobe height and the four radii which come in for consideration in the design of any multi-lobed ring cam for a radial type engine, specifically one in which the cam follower moves one-half the distance of its full travel while the cam rotates one-half the angular distance between zero and maximum lift. It presented ready means for establishing the geometric relationships of these five variable factors at any included cam angle, relationships that are known to provide the lowest possible acceleration under any given set of conditions. In this second part we will consider the numerical values of the accelerations that are developed with this particular form of cam, and endeavor to present through charts and discussion the means by which their determination can be greatly simplified.

Preliminary to any discussion on this subject, however, it would be well to give some thought to the general procedure employed in problems of this kind. Procedure is of primary importance in any plan that aims to avoid tedious computations.

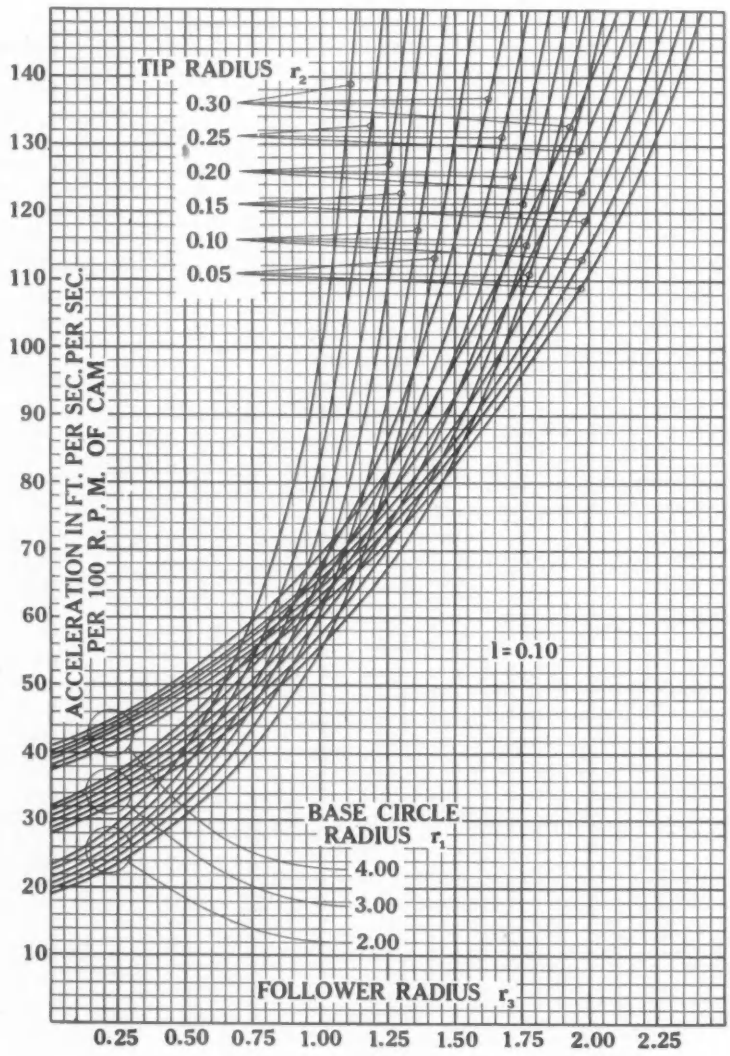


Fig. 5. Values of first term in acceleration equation plotted to show the effect of follower radius. (Dimensions in inches)

The usual routine of designing a cam and then providing a valve spring or springs of sufficient load to compensate the forces resulting from its follower accelerations may do quite well for slow-speed engines, but it can lead into difficulties and the expenditure of much engineering effort whenever high-speed operation is involved. Full recognition of the problem seems to point to the logic of designing a cam on the basis of an acceleration that is known to be permissible with some predetermined valve spring load, or some relatively narrow range of load, and thereby eliminate all uncertainties and the unnecessary waste of energy which the first method often entails. This more direct method of approach more or less forms the basis of the present examination, and the greater efficiency resulting therefrom should become apparent as the discussion advances.

Regarding the question of spring load, past experience normally serves as a fairly dependable index. Lacking information of this sort, however, it is always possible to make sufficient quick preliminary calculations to establish a sensible range. It seems needless to enumerate the reasons why the spring load should be no greater than necessary.

Worthy of emphasis at this point is the fact that proper valve spring design is in itself a matter of vital importance. Seldom can anything be gained by inviting the dangerous consequences that frequently follow departures from proved practices. Interest should center about having, within the space limitations which certain other design considerations usually dictate, a spring or springs operating within a narrow stress range and having a maximum

Design Simplified

Part Two

Determination of Cam Lobe Dimensions to Conform with Acceleration Limitation

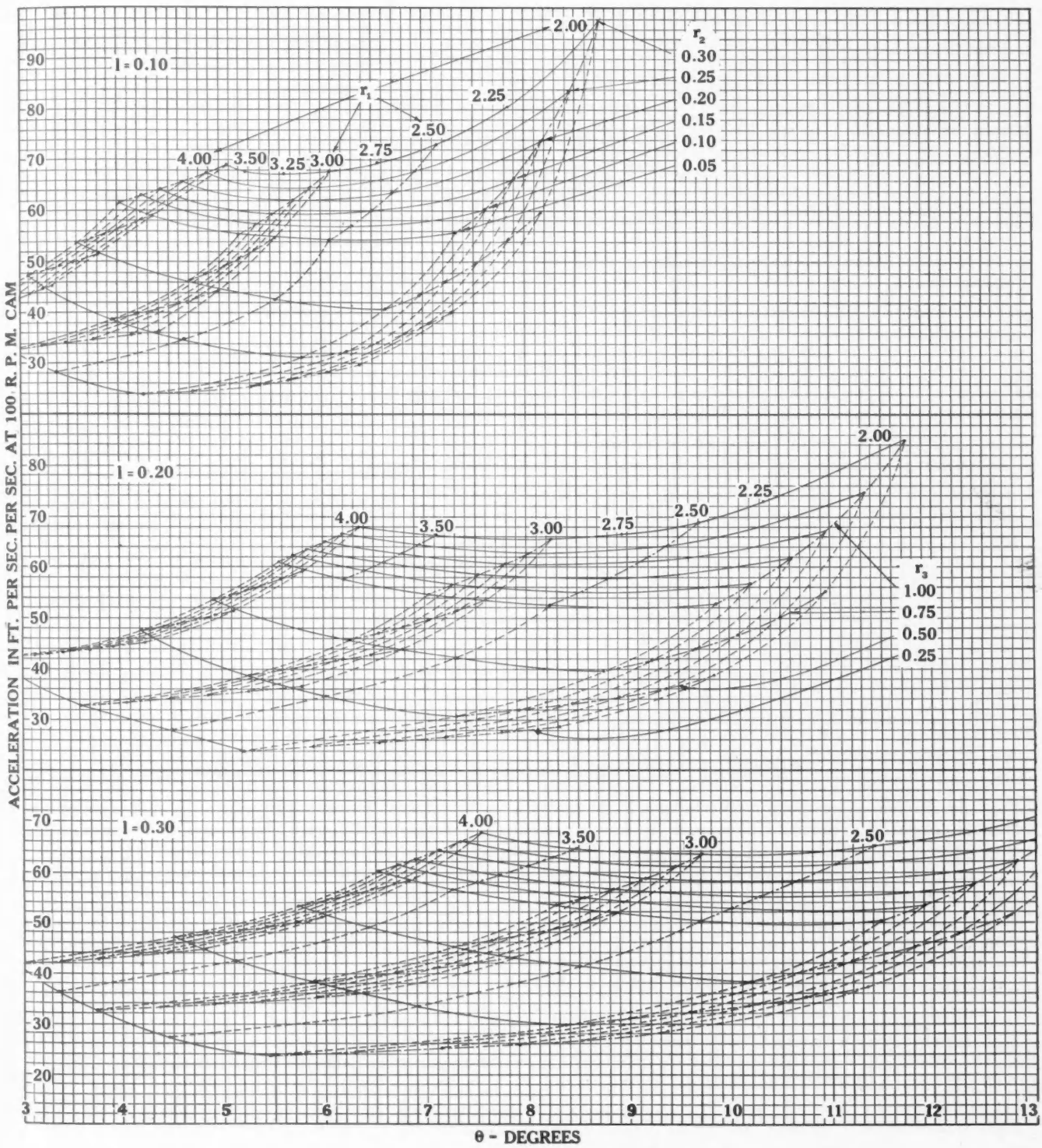


Fig. 6. Values of first terms in acceleration equation plotted at three different cam lobe heights. (Dimensions in inches)

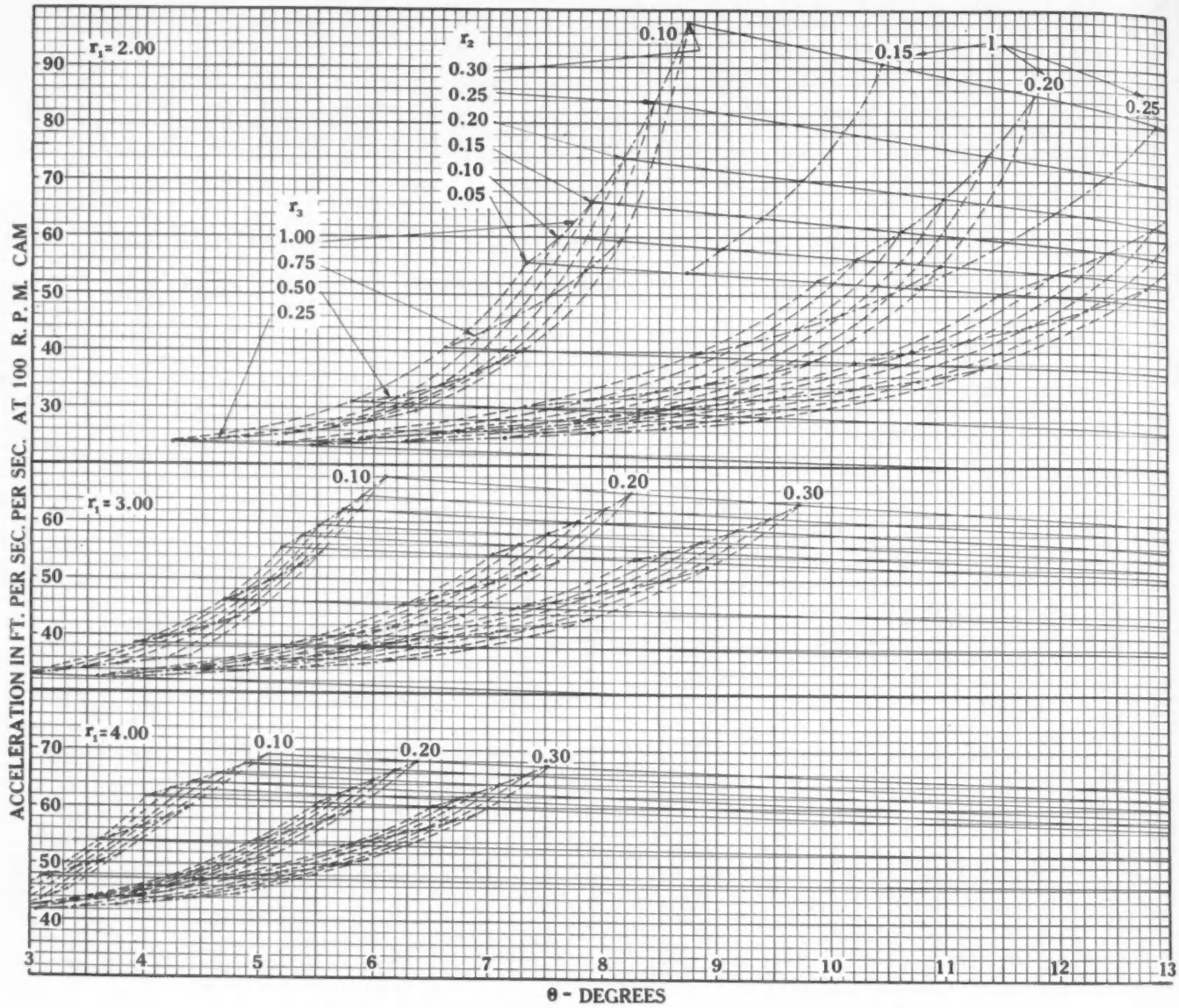


Fig. 7. Values of first term in acceleration equation plotted for three different base circle radii. (Dimensions in inches)

stress below the fatigue limits established on the basis of material, wire diameter and nature of the service. Also, whenever possible, it is preferred to have a spring with a high natural frequency.

These essential considerations do not represent the whole story, of course, but perhaps they are sufficient to support the recommendation that a well-designed spring of adequate load should not be altered except when deemed absolutely necessary. Moreover, changing a design to provide greater load should always be preceded by an examination to determine whether the cam contour, rocker arm ratio, etc. are optimum in the light of actual requirements.

In this discussion it will suffice to assume that an adequate spring exists, or can be provided, and the purpose here is to establish cam dimensions giving a specified valve lift and opening period that do not introduce accelerations and accompanying forces at operating speed in excess of those known to be permissible.

Determination of rocker arm ratio should be regarded as one of the major parts of investigations of this sort. The relative lengths of the arms on the valve and push rod sides of the fulcrum fix the ratio of cam lobe height to valve lift. The height of the lobe for the socalled ideal cam is controlled within certain limits by the included angle, base circle, roller radius, etc. Therefore, it becomes apparent that some phases of rocker arm design must be taken into account during the cam analysis.

A valve rocker arm represents a form of simple beam, and consequently the forces applied at its valve and push rod ends must vary inversely with their distance from the fulcrum. Accordingly, the weight equivalent of the reciprocating parts referred to either axis must vary substantially in the same order. By means of the simple force equation $F = ma$, or $F = Wa/g$, the permissible acceleration along the push rod axis may be determined from the spring force at one-half valve lift and the weight equivalent of all reciprocating masses when both are referred to this axis. Engine power losses and other troubles that occur when this acceleration is exceeded are too well known to require further discussion here.

The equation for acceleration with a hollow-face cam now comes in for consideration, and for sake

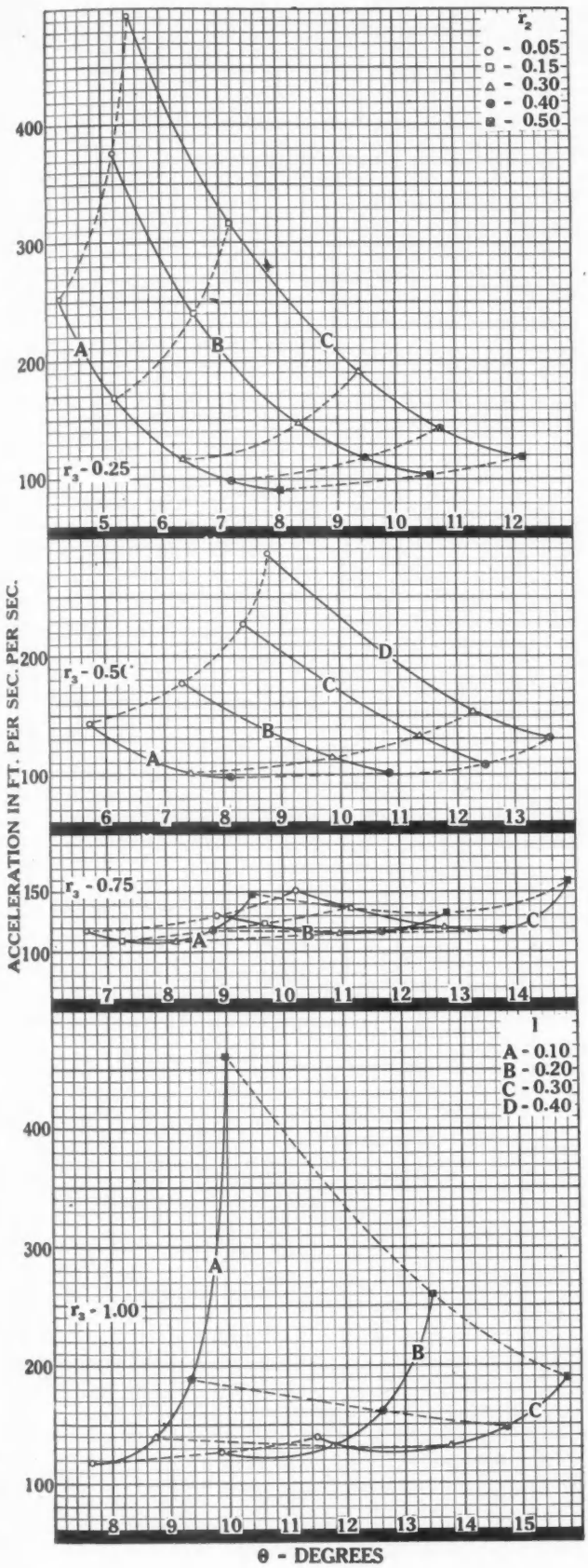


Fig. 8. Acceleration at 100 rpm of cam of 2-in. base circle radius representing second term of equation 11. (Dimensions in inches)

of completeness equations for lift and velocity should be included as well. All three equations given are applicable only to the lower motion, that is, when the cam follower is in contact with the flank. Corresponding expressions for the nose or upper motion are the same as for the tangential type cam and are of no particular concern in the present discussion. The lift of the cam follower in inches is

$$l = (r_1 + r_4)\cos\theta - [(r_4 - r_3)^2 - (r_1 + r_4)^2 \sin^2\theta]^{1/2} - (r_1 + r_4) + (r_4 - r_3) \quad (8)$$

and the velocity in feet per second is

$$v = 0.00873\, N(r_1 + r_4)\sin\theta \left[\frac{(r_1 + r_4)\cos\theta}{[(r_4 - r_3)^2 - (r_1 + r_4)^2 \sin^2\theta]^{1/2}} - 1\right] \quad (9)$$

and the acceleration in feet per second per second is

$$a = -0.000914\, N^2 \left[(r_1 + r_4)\cos\theta + \frac{(r_1 + r_4)^2 \{(r_1 + r_4)^2 \cos^4\theta - [(r_1 + r_4)^2 - (r_4 - r_3)^2]\cos^2\theta\}}{[(r_4 - r_3)^2 - (r_1 + r_4)^2 \sin 2\theta]^{3/2}}\right] \quad (10)$$

The term N in the above expressions represents cam ring revolutions per minute. Symbols r_1, r_2, r_3 and r_4 are the radii of base circle, tip, follower and flank, respectively, as indicated in Fig. 1. Although θ in this diagram refers to the termination of the lower motion, and is the only angle of interest in this investigation, it incidently represents any angle during that portion of the cam movement in these equations.

The layout presented in Fig. 1, as explained in the first part of this article, represents a relationship of r_1, r_2, r_3 and r_4 for a given lobe height at any angle θ which should give minimum acceleration for a given set of conditions. The reason, of course, lies in the fact that acceleration and deceleration occur at equal and maximum angular movements of the cam for any given included angle. Obviously, if the follower moved one-half of its travel during a shorter time it would have greater velocity and acceleration at some point. The relationship referred to is expressed principally by equations 4 and 5, and it forms the basis for computed accelerations presented on the accompanying charts.

It is evident that the use of equation 10 in determining cam follower acceleration involves a great deal of mathematical work, in fact far more than one can afford to devote to such a task ordinarily. It may par-

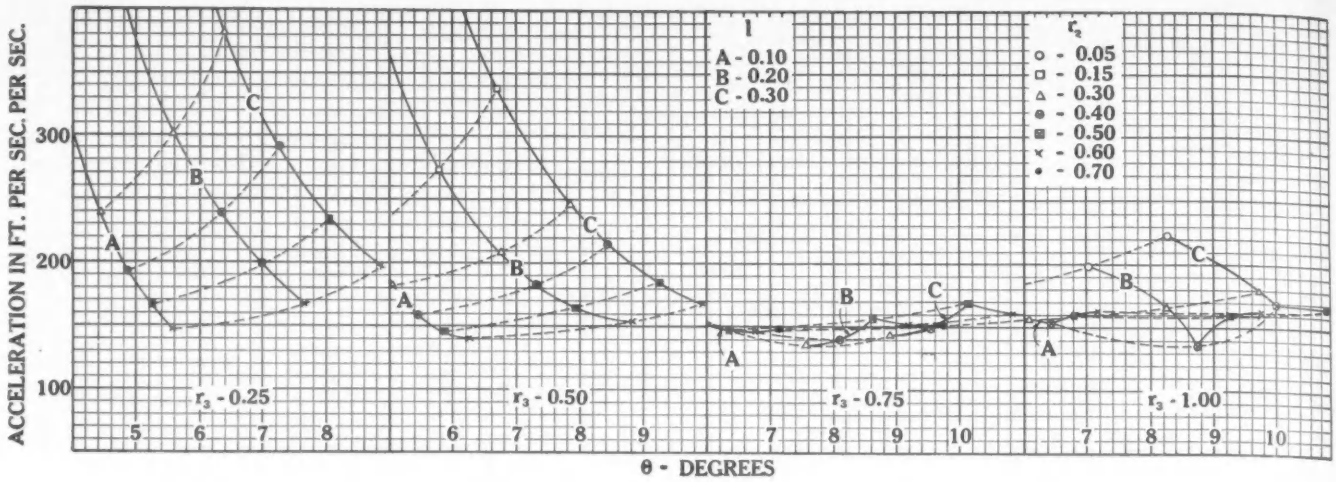


Fig. 9. Acceleration at 100 rpm of cam of 3-in. base circle radius representing second term of equation 11. (Dimensions in inches)

tially explain why so many designers prefer to use graphical methods. However, acceptable results by means of the latter methods are attained only with large scale layouts and meticulous care, and it is the author's experience that greater accuracy at critical points is required in the majority of problems of this sort. Since the values of $cos^4\theta$ and $cos2\theta$ only vary slightly in the third and fourth decimal place among the angles with which we are concerned, it is possible to simplify the second term in the bracket of equation 10 and thus eliminate a considerable amount of tedious work. The simplified equation then may be written

$$a = -0.000914\ N^2 \left[(r_1 + r_4)\ cos\theta + \frac{(r_1 + r_4)^2 (r_4 - r_3)^2 cos\ 2\theta}{[(r_4 - r_3)^2 - (r_1 + r_4)\ sin^2\theta]^{3/2}} \right] \quad \ldots\ldots\ldots\ldots (11)$$

The values for the first and second terms in the bracket are unrelated and so it becomes necessary to investigate them separately. Figs. 5, 6 and 7 represent the first term of equation 11 at a cam speed of 100 rpm and, as stated previously, they are based upon relationships expressed by equations 4 and 5. The dimensions employed in this investigation practically cover the range necessary among modern radial engines; namely, cam lobe heights designated l are 0.10, 0.20 and 0.30 in.; base circle radii r_1 are two, three and four in.; tip radii r_2 are 0.05, 0.10, 0.15, 0.20, 0.25 and 0.30 in.; follower radii r_3 are 0.25, 0.50, 0.75 and 1.00 in., and in some cases higher. These are presented in such a way that intermediate values, or even values outside this range, may be determined with reasonable accuracy by interpolation.

The influence of cam follower radius upon acceleration is shown by Fig. 5. Actually the higher accelerations are due directly to the increase in flank radius required with a larger radius for the follower. A group of curves represents the six differ-

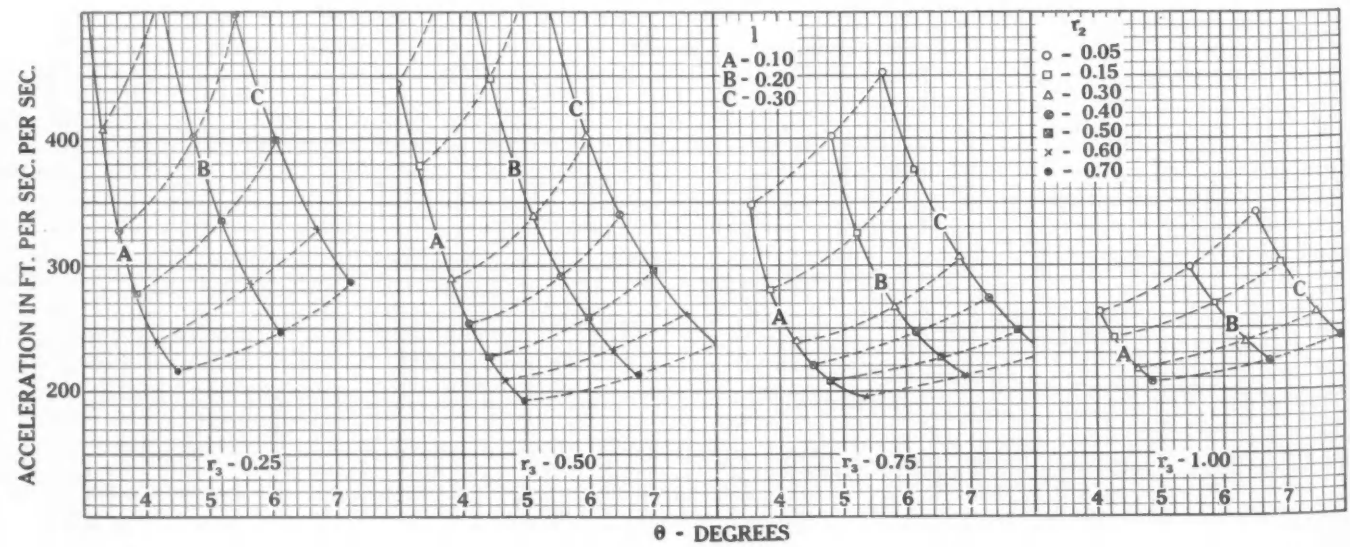


Fig. 10. Acceleration at 100 rpm of cam of 4-in. base circle radius representing second term of equation 11. (Dimensions in inches)

ent tip radii for each of the three base circle radii, and the lift l in each instance is 0.10 in. The curves are typical for higher values of l, the only change being a slight shift to the right at higher accelerations, which means that an increase in lift calls for a larger follower radius for the same acceleration. While these curves bring out rather clearly how first term accelerations are influenced by dimensions, they have no direct bearing upon any specific design problem for the reason that the cam angle is not taken into account.

Since the cam angle is fixed within limits for each individual cam design problem, the computed values have been plotted with respect to it in the subsequent diagrams. In Fig. 6 will be found a set of curves for each of the three lifts considered, and Fig. 7 shows corresponding values for each of the three base circle radii. By making use of both diagrams and interpolating for all intermediate points, it should be possible to obtain reasonably close values for any of the principal cam dimensions at any angle θ for the acceleration permissible. The range of three to 13 deg for θ covers all radials except a three-cylinder engine whose cam turns at one-half crankshaft speed.

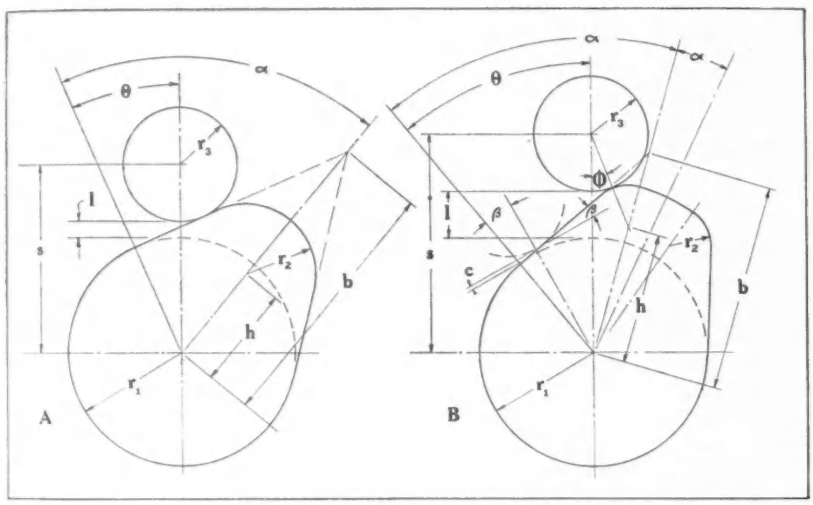


Fig. 11. Diagram showing upper movement of single lobed tangential cam.

The curves give the effect of being three dimensional, in fact, the base circle for a range of tip and follower radii appears to be represented by a warped plane. In order to lessen the possibility of confusion, only those lines considered essential are included. As a further aid, the four follower radii with each base circle are shown by dot and dash lines, and the tip radii with each base circle are shown dotted. The full lines represent tip radii at selected follower radii. No difficulty should be experienced due to lines omitted because their course is quite apparent. Extended discussion with reference to the characteristics of these curves seems unnecessary. Attention is called, however, to the fact that, with each follower radius, the lines for tip radii representing lift for any given base circle radius have a common point of convergence (see Fig. 7).

Accelerations represented by the second term in the bracket of equation 11 are given for three typical base circle radii by Figs. 8, 9 and 10. These are invariably the higher of the two, being as a rule three or more times the value represented by the first term. For this reason, it would seem advisable to give them first consideration in the course of selecting dimensions for any specific design problem. Again the reader is reminded that the relationships of the six variables involved are based on those expressed principally by equations 4 and 5.

Characteristics of Chart Curves

While the curves shown on these charts should not require detailed explanation, it nevertheless might be well to direct attention to some of their more significant characteristics. In general, they follow an approximate parabolic path, θ increasing and the acceleration decreasing in each instance to a certain point with an increase in tip radius. Sometimes the curves begin to rise again with further increase in tip radius, and in other cases they have not begun to reverse their course when the maximum permissible tip radius is employed. In any case, it would seem desirable to select a tip radius at the required angle θ, for any lift and follower radius, that gives minimum acceleration.

If the curves for all base circle radii at a given lift are superimposed, they will be found to fall within a relatively narrow path. Of course, the position of a point representing given tip and follower radii for one base circle radius will fall at a different angle θ and show a different acceleration than for another. Comparison of the four follower radii, r_3, for any base circle shows that at any lift the tip radius moves to the right along this parabolic path as the follower radius is increased. It is evident also that in general the acceleration is greater and a larger angle θ is required as the lift is increased for each combination of tip and follower radii.

There appears to be a region of near minimum acceleration over a fairly wide range of the angle θ for each base circle radius. This is particularly noticeable when the follower radius is 0.75 in. With the latter, as well as with a follower radius of 1.00 in., the curves for the three-in. base circle radius change in direction beyond some particular tip radius. Perhaps this might occur with other base circle radii if sufficient points were computed to cover the entire range. Anyway, this is in the region of curve reversal and need not be construed as error because the calculations were carefully checked. The tip radius becomes important only as it fixes the angle θ at which minimum acceleration is attainable.

It is obviously desirable to employ the smallest practical base circle when seeking minimum acceleration at any angle θ. The larger the angle θ, the smaller the base circle for minimum acceleration. Fortunately, with more engine cylinders, the cam speed is lower and the angle θ becomes smaller, and it is possible to employ the larger base circles required in such designs without introducing prohibitive cam follower accelerations. Moreover, by rotating the cam ring in the direction opposite to that of the crankshaft, as is done in most all large radial engines, a further reduction in speed and the angle θ is acquired.

Usefulness of Charts

It is hardly proposed that these charts, presented mainly to show the influence of changes in one or more of the six variables, are to be employed as the sole means for designing a ring cam. While it is true that fairly close approximations may be secured, it is advisable to compute accelerations once certain dimensions have been decided upon, especially when interpolating between lifts, follower and base circle radii. The usefulness of the diagrams comes mainly through the opportunity afforded to select practical dimensions and proportions very quickly, those that approach the optimum as far as minimum acceleration is concerned. In order to illustrate this point, a typical example is considered.

Assume that a ring cam for a seven-cylinder radial engine is to be designed, and the speed of rotation is to be one-eighth that of the crankshaft. The lift of the valve in this engine is to be 0.40 in., and its total opening period is 256 deg of crankshaft travel. The included cam angle is then 32 deg and θ is eight deg. Therefore, along the eight-degree ordinates of Figs. 6 to 10 it should be possible to determine approximate dimensions for a cam lobe which will not introduce follower accelerations at operating speeds exceeding those known to be permissible.

Continuing with other needed data, assume that the engine has propeller reduction gears and its maximum operating speed is 2800 rpm. Allowing an additional 400 rpm as a measure of safety means that the cam speed should be figured at 400 rpm. Since all charts are based on 100 rpm, the acceleration must not exceed $(400/100)^2$, or 16 times the sums of values representing first and second terms of equation 11.

Further assumptions will be that the equivalent spring load is 120 lb when the valve is at mid-lift, and the total weight of the reciprocating portion of the valve gear referred to the push rod axis is 1.4 lb. Substituting in the simple force equation, $F = Wa/g$, it is found that the permissible acceleration is 2,760 fps^2. At 100 rpm, where the acceleration is only 1/16th of this value, it is evident that 172 fps^2 should not be exceeded.

With limits established on the basis of the preceding specifications, the first question is how to start making use of the information contained in the diagrams. Usually there are practical space considerations in any design that establish the limits for one or two dimensions. It is assumed in this instance that it is possible to have a base circle radius as small as two in., and a roller diameter that does not exceed one in. Referring to the chart of Fig. 8 for $r_3 - 0.50$ in., it is found that if the lobe height is 0.20 in., the acceleration represented by the second term in the bracket of equation 11 will be about 158 fps^2. From Fig. 6, which represents the first term in the bracket of equation 11, these same dimensions give an acceleration of 32 fps^2. Their sum, 190 fps^2 at 100 rpm, is more than 1/16th of the value permissible with this spring at 3200 rpm of the engine.

This spring, however, should be satisfactory up to an engine speed of about 3040 rpm if friction is neglected, otherwise an equivalent spring load of 132 lb appears to be necessary. As stated previously, springs should not be changed for such minor differences in load requirements if they are satisfactory in every other respect, especially when the problem can be solved much easier by changing the cam. Suppose, in this instance, that the lobe height is made less than 0.20 in., possibly 0.18 in., which would mean a rocker arm ratio slightly over 2 to 1.

Oftentimes, an increase in the valve opening period may offer a simple solution. Suppose, in this instance, that an increase in θ from eight to nine deg. is considered, which corresponds to 288 deg of crankshaft travel for the valve opening. It will be found that for 0.20-in. lift the acceleration becomes 34.5 and 132, respectively, for first and second terms of the equation, or 164.5 fps^2, which is well under the permissible figure previously determined. A slight reduction in acceleration may be effected for the first term of the equation by the use of a smaller follower radius, but it is barely enough to warrant consideration. Apparently, the tip radius, r_2, in the first instance would be about 0.11 in., and about 0.21 in. when θ is nine deg.

The example just considered was selected quite arbitrarily, and it should suffice to illustrate one of the many ways in which these charts may be employed for quick cam contour determinations. Arriving at the same results by trial and error computations would have consumed a number of hours. Moreover, with computed results, one is never quite sure that the best possible combination of dimensions for minimum acceleration have been employed.

Deviations from Ideal Proportions

In directing attention once more to the fact that all diagrams are based upon the layout shown by Fig. 1, it should be added also that they are not to be depended upon for cam contours which deviate from these established relationships. Without complete data on existing radial engine cams, it is impossible to state how many actually conform with these proportions or how many are subject to some improvement. Experience has shown that even slight machining deviations from specified cam contours result in substantial increases in acceleration and by the same token it is to be expected that deviations from an ideally proportioned contour will show corresponding effects. Sometimes, because of space restrictions in the design and their effect upon certain dimensions such as the base circle and follower radii, it may not be possible to conform exactly with these so-called ideal proportions, particularly at the larger values of θ. In such instances, the only course open is to ap-

proach them as closely as practical considerations permit.

Upper Motion

Up to this point, Part II of this article has been devoted exclusively to the motion of the cam follower during its contact with the flank of a hollow-face cam. Ordinarily, consideration of the upper motion; that is, the follower movements when in contact with the nose or tip radius, might be expected to follow if only for sake of completeness. However, it is primarily for the purpose of recognizing the greatly simplified expressions for lift, velocity and acceleration with this so-called ideal cam layout that the upper motion is accorded this supplementary examination.

The upper motion is unaffected by the shape of the flank, therefore, the diagram shown by Fig. 11 for a single-lobed tangential cam will serve adequately as a reference for the symbols employed. It should not be necessary to take up the separate mathematical steps in the development of the equations which have long been in use for computing the lift, velocity and acceleration of the follower during the upper motion. Presentation is aimed primarily at directing attention to the greater amount of work which they involve as compared with those for a cam which raises the follower one-half of its total travel during an angular movement equal to one-half the distance between zero and maximum lift.

The cam follower lift in inches during the upper motion is

$$l = h\cos(\alpha - \Theta) + (r_2 + r_3)\cos\Phi - (r_1 + r_3) \quad \ldots\ldots (12)$$

For convenience, it is better to have an expression in terms of θ. Since $\sin\phi = h\sin(\alpha - \theta)/(r_2 + r_3)$, it is possible to make substitutions and reduce, thereby obtaining the following equation,

$$l = h\cos(\alpha - \Theta) + [(r_2 + r_3)^2 - h^2\sin^2(\alpha - \Theta)]^{1/2} - (r_1 + r_3) \quad \ldots\ldots (13)$$

A much simpler form which introduces minor errors at small values of θ is written

$$l = h\cos(\alpha - \Theta) + (r_2 + r_3)\cos\left(\frac{h(\alpha - \Theta)}{r_2 + r_3}\right) - (r_1 + r_3) \quad \ldots\ldots (14)$$

It is believed that this expression was developed originally by A. L. Nelson, and it appeared in *The Horseless Age* of September 23, 1914. It is based upon the theory that, because the sines of small angles are nearly equal, it can be assumed that $\phi = h(\alpha - \theta)/(r_2 + r_3)$ and this substitution may be made in equation 12.

However, with a cam layout which provides a movement of one-half lift when the cam has moved one-half the angular distance between zero and maximum lift, ϕ and θ are equal. Also, $h = r_2 + r_3$, and substitution in either of the preceding equations reduces to

$$l = 2h\cos(\alpha - \Theta) - (r_1 + r_3) \quad \ldots\ldots (15)$$

Follower velocity in fps, obtained by differentiating equation 13, is

$$v = -0.00873\,N\,h\left[\sin(\alpha - \Theta) + \frac{\sin(\alpha - \Theta)\,h\cos(\alpha - \Theta)}{[(r_2 + r_3)^2 - h^2\sin^2(\alpha - \Theta)]^{1/2}}\right] \quad \ldots\ldots (16)$$

and similarly equation 13, which gives a small error except for the special case referred to in the preceding paragraph, would become

$$v = -0.00873\,N\,h\left[\sin(\alpha - \Theta) + \sin\left(\frac{h(\alpha - \Theta)}{r_2 + r_3}\right)\right] \quad \ldots\ldots (17)$$

In the case where $\phi = \theta$, equations 16 and 17 reduce to the following simple form

$$v = -0.01746\,N\,h\sin(\alpha - \Theta) \quad \ldots\ldots (18)$$

Differentiating equation 16 gives follower acceleration in fps per sec, and when reduced it is written

$$a = -0.000914\,N^2\,h\left[\cos(\alpha - \Theta) + \frac{h[(r_2 + r_3)^2\cos 2(\alpha - \Theta) - h^2\sin^4(\alpha - \Theta)]}{[(r_2 + r_3)^2 - h^2\sin^2(\alpha - \Theta)]^{3/2}}\right] \quad (19)$$

Similarly differentiating equation 17 provides a much simpler equation for follower acceleration but, aside from the special case where ϕ and θ are equal, it may introduce errors too great for the desired accuracy at high rotational speeds. This equation is

$$a = -0.000914\,N^2\,h\left[\cos(\alpha - \Theta) + \frac{h}{r_2 + r_3}\cos\left(\frac{h(\alpha - \Theta)}{r_2 + r_3}\right)\right] \quad \ldots (20)$$

However, in cases where ϕ and θ are always equal and, of course, $h = r_2 + r_3$, equations 19 and 20 reduce to

$$a = -0.001828\,N^2\,h\cos(\alpha - \Theta) \quad \ldots\ldots (21)$$

A mere glance at equations 15, 18 and 21, when comparing them with the general expressions for lift, velocity and acceleration during the upper motion of the cam follower, clearly indicates the enormous time saving that results from their use. While this might be taken as a point in favor of the particular cam layout which forms the basis of this examination, it is, of course, the lower acceleration obtained under a given set of conditions at the change from lower to upper motion, or vice versa, as dealt with previously, that really commends its adoption.

TABLE I—COMPARATIVE PERFORMANCE OF PRESENT RECIPROCATING AND TURBINE ENGINE TYPES

	Supercharged Reciprocating Engine with Propeller	Compound Reciprocating Engine with Propeller	Turbo-jet	Turbo-prop
Take-off bhp	3000	3600	....	3000
Static Thrust (lb)	9000	10500	6000	9900*
Thrust at 375 mph, sea level, 85% prop eff (lb)	2550	3060	6000	3450
Thrust at 600 mph, sea level, 70% prop eff (lb)	1310	1575	6000	2210
Brake specific fuel cons.—take-off (lb per hp per hr)	.84	.68	....	.99
Brake specific fuel cons.—cruise (lb per hp per hr)	.42	.35	....	.75
Thrust specific fuel cons.—take-off (lb per lb thrust per hr)	.28	.23	1.20	.30
Thrust specific fuel cons.—cruise at 375 mph** (lb per lb thrust per hr)	.50	.41	1.03	.65
Thrust specific fuel cons. cruise at 600 mph** (lb per lb thrust per hr)	.95	.80	1.03	1.00
Engine weight (lb)	3600	4280	2400	2900
Specific eng wgt at take-off hp (lb per hp)	1.20	1.19	....	.97
Specific eng wgt at take-off thrust (lb per lb thrust)	.40	.41	.40	.29
Installed eng wgt (lb)	4600	5300	2900	3700
Specific installed wgt at t.o. thrust (lb per lb thrust)	.51	.51	.48	.37
Specific installed wgt at 375 mph (lb per lb thrust)	1.8	1.7	.48	1.1
Specific installed wgt at 600 mph (lb per lb thrust)	3.5	3.4	.48	1.7

* Includes 10% jet thrust.
** 65% cruise power for recip. eng., 85% for turbine engines.

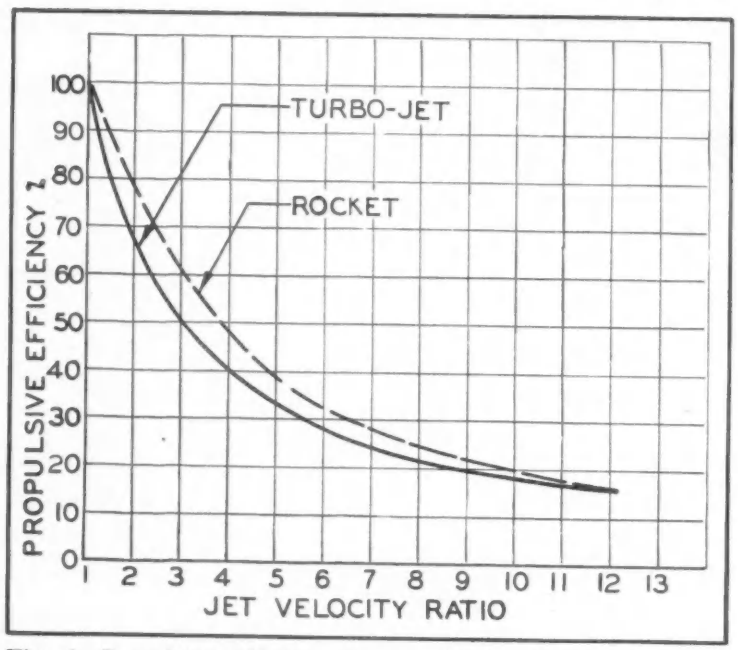


Fig. 1—Propulsion efficiency curves for turbo-jet and rockets.

$$\text{Propulsion efficiency} = \frac{\text{thrust hp}}{\text{kinetic energy hp}}.$$

$$\text{Turbo-jet eff} = \frac{\frac{mV}{550}(c - V)}{\frac{1}{2}\cdot\frac{m}{550}(c^2 - V^2)} = \frac{2}{R + 1}$$

$$\text{and rocket eff} = \frac{\frac{mcV}{550}}{\frac{1}{2}\left(\frac{mc^2 + mV^2}{550}\right)} = \frac{2R}{R^2 + 1}$$

where m = mass per unit time, c = jet velocity, V = airplane velocity and R = jet velocity ratio $\frac{c}{V}$. This concept of propulsion efficiency is derived from conventional practice of defining efficiency as useful power divided by total power, but is misleading when used for jet propulsion. Note that the curves indicate improving efficiency as the jet velocity is reduced relative to forward velocity, reaching 100 per cent when the two velocities are equal. This is an impossible situation since from the thrust equation [T = m (c−V)], the thrust is zero.

Jet Propulsion

By Henry C. Hill
Formerly Manager, Turbine Engineering Department
G.M. Giannini & Co., Inc.

ANYONE who has studied the theory of jet propulsion must be aware of a number of paradoxical situations in the currently accepted treatment. For example, the concept of propulsive efficiency for an air-burning jet engine indicates that the efficiency will be 100 per cent when the jet speed is equal to the flight speed, under which condition the thrust is zero. This familiar efficiency curve is shown in Fig. 1. It is hard to visualize the real meaning of such an efficiency relation, especially when this relation indicates little future for jet propulsion except at very high airplane speeds.

The present theory dictates that efforts should be directed toward reducing jet velocities in order to improve the efficiency of propulsion, yet the actual trend is toward higher jet velocities. In the rocket field, research efforts are directed toward the highest possible jet speeds in order to improve thermal efficiency and reduce fuel consumption.

These examples are cited not necessarily to suggest that the present theory is in-

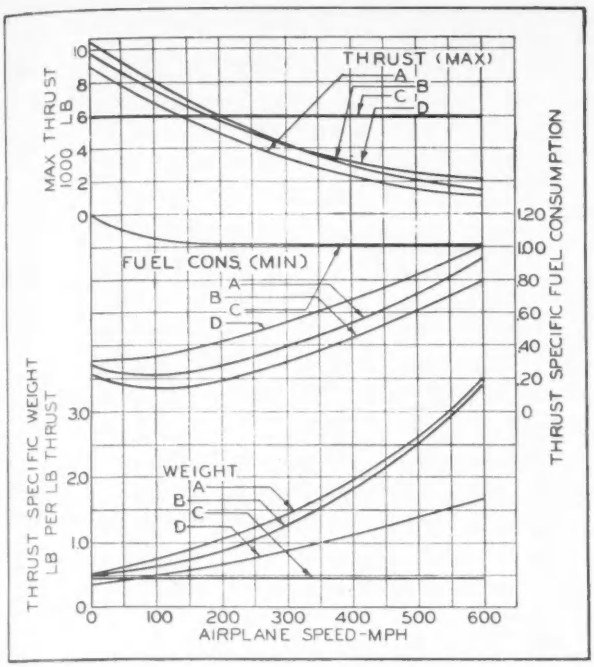


Fig. 2—(Left) Comparative engine performance versus airplane speed. A is reciprocating engine, B compound engine, C turbo-jet, and D turbo-prop

Can Be Efficient at Low Speeds

correct, but rather that it may be misleading to developmental thinking on the future of jet propulsion. Thus, if there are defects in the theoretical explanation, then the field of jet propulsion perhaps may not be limited to the highest airplane speeds and short ranges, as commonly supposed.

It is possible to compare jet and propeller power plants adequately without worrying about propulsive efficiency, using instead merely thrust (in lb), specific fuel consumption (lb of fuel per lb of thrust per hr), and weight (in lb per lb of thrust). These are simple engineering terms, readily measurable and easily understandable in comparing power plant performance. Together with the drag of the installed power plant, they define the performance of any given airplane. Table I was made up on this basis, comparing the performance of four basic types of power plants for man-carrying aircraft. For each type, the largest current output was chosen, 3000 hp being considered representative for piston engines and turbo-props, and 5000 lb thrust for turbo-jets. The figures purposely do not follow any specific existing models, nor have projected performance data for non-established types been considered. Take-off thrust of the propeller engines has been shown as three times the brake horsepower, this being a relation well established by experience for good propeller-engine installations. To complete the performance comparison altitude characteristics should, of course, be included. However, all four engine types are affected by altitude in roughly a similar manner, so that altitude data need not be listed.

It can be seen that the 3000-hp reciprocating engine provides around 9000 lb static thrust as compared to 5000 lb for the largest turbo-jet at the present time, and that the thrust specific fuel consumption at take off is 0.28 for the piston engine against 1.2 for the turbo-jet. Thus, at the lowest airplane speeds, the jet engine has only 55 per cent as much thrust as the piston engine and uses over twice as much fuel. But as the speed of the airplane is increased, as shown by the curves of Fig. 2, the relative positions of the two engines begin to reverse, until at 600 mph the turbo-jet thrust is 4½ times better than the piston engine and the specific fuel consumptions are about equal.

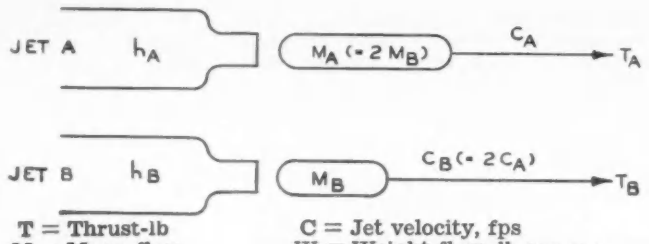
It is evident that the thrust of the turbo-jet has not increased appreciably nor its fuel consumption decreased as the speed was raised, but rather that the good characteristics of the piston engine have suffered because of the increasingly poor performance of the propeller. The inference is that the jet engine is poor thermodynamically as compared to the piston engine, and that the propeller is poor aerodynamically at high speeds as compared to the jet.

Or, to put it another way, the above mentioned figures suggest that there is nothing basically wrong with a jet as a means of propulsion at low speeds, or any speed for that matter, rather the defect is in the power plant which energizes the jet.

These are highly interesting conclusions, if true, for they open new vistas for jet propulsion power plants for long range transports and bombers, and particularly for the small airplane. It might even be possible to start fresh thinking on the flying automobile, if an efficient turbo-jet engine were available which could provide a wheel drive on the ground and jet propulsion in the air, with a vehicle configuration that would not have to accommodate a propeller.

To support these conclusions it is necessary to investigate the thermodynamics involved in the above conclusions, and finally, to complete the study, it will be necessary to explore the means of improving turbo-jet thrust and thermal efficiency.

Until very recently, thermodynamic analysis of the gas turbine has involved laborious and relatively complex calculations. It would appear that the important criteria have sometimes been obscured by the number of variables and their inter-related effects on the performance of the machine as a whole. A great deal of progress has been made toward simplification of the analytical process, notably through the efforts of Professors Keenan and Kaye, and others, in providing tables for the quick determination of enthalpy, or heat content per pound of fluid at any point in an



T = Thrust-lb
M = Mass flow
g = 32.2 ft per sec per sec
h = Enthalpy drop, Btu per lb
C = Jet velocity, fps
W = Weight flow, lb per sec
F = Fuel weight flow, lb per hr of air (required to produce jet velocity C)

$$T_A = T_B = M_A V_A = M_B V_B = \frac{W_B}{g} V_B = \frac{W_B}{g} (2 V_A) \text{ or } W_A = 2 W_B$$

$$\text{Fuel-air ratio} = \frac{\text{lb fuel per hr}}{\text{lb air per hr}} = \frac{F}{W \times 3600}$$

For the same mixture strength during combustion:

$$\frac{F_B}{W_B \times 3600} = \frac{F_A}{W_A \times 3600} = \frac{F_A}{2W_B \times 3600} \text{ or } F_B = \frac{1}{2} F_A$$

$$\text{Specific Fuel Consumption} = \frac{\text{lb fuel per hr}}{\text{lb thrust}} = \frac{F}{T}$$

$$\frac{F_B}{T_B} = \frac{\frac{1}{2} F_A}{T_B} = \frac{1}{2}\left(\frac{F_A}{T_A}\right)$$

$$\text{Enthalpy Drop, } h = \left(\frac{V}{224}\right)^2, \; h_B = \left(\frac{V_B}{224}\right)^2 = \left(\frac{2 V_A}{224}\right)^2 = 4\left(\frac{V_A}{224}\right)^2 = 4 h_A$$

$$\text{Thermal Efficiency} = \frac{\text{heat into work}}{\text{heat in fuel}} = \frac{hW\ (3600)}{F\ (18{,}600)}$$

Thermal Efficiency of Jet B =

$$\frac{h_B W_B\ (3600)}{F_B\ (18{,}600)} = \frac{4 h_A\ (1/2\ W_A)\ (3600)}{1/2\ F_A\ (18{,}600)} =$$

4 times thermal eff. of Jet A

Fig. 3—For equal thrust, the jet with twice the velocity has half the fuel consumption and four times the thermal efficiency

internal combustion machine utilizing the compression, burning and expansion of air. The work input or output for each of the components is then readily obtained by subtraction of the enthalpies, giving the rise or drop in enthalpy, from which the work input required or work output available is obtained via the mechanical equivalent of heat. This method provides an invaluable tool for the design engineer, permitting evaluation of new ideas looking toward improvement of gas turbine cycle performance.

The following simple explanation derived from the use of these methods is offered as proof of the proposition that jet propulsion can be efficient at low speeds as well as at high speeds, and that there is no fundamental barrier to the development of a jet powered airplane that can equal or exceed the takeoff and cruise performance of propeller powered craft in the low speed range. The initial assumption is made that the point will be proved if the truth of the following two supporting statements is established:—

1. A high jet velocity, if accompanied by sufficiently high thermal efficiency, is more efficient than a low jet velocity.
2. The increased thermal efficiencies required to produce higher jet velocities to permit efficient jet propulsion at low speeds—are within the range of practical attainment.

Statement (1) is a contradiction of the popular belief that it is always more efficient for propulsion purposes to move a large mass of air at low velocity than a small mass of air at high velocity. The latter statement is frequently seen in explanation of why the propeller is better at low speeds than the jet, and it stems from the propulsive efficiency concept which, by definition, says that when the velocity of the propelling fluid is high relative to the vehicle velocity, then the efficiency of propulsion is poor *"because kinetic energy is wasted."*

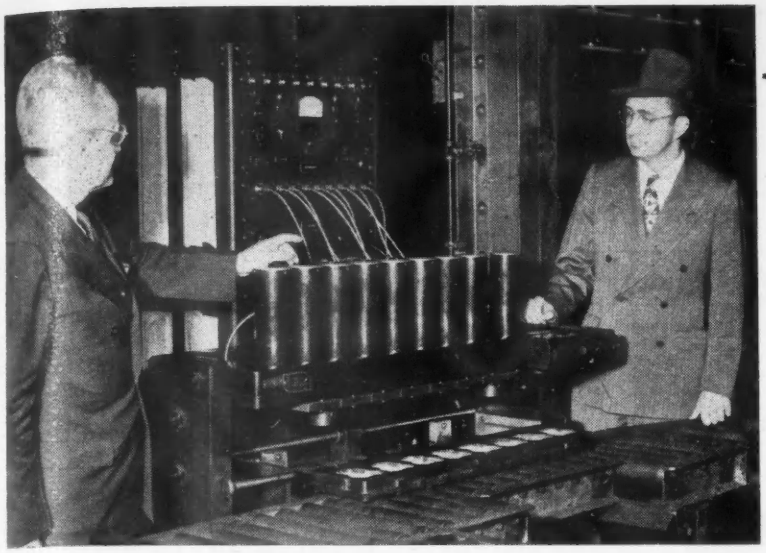
But the facts do not completely bear this out. Two jets A and B, as illustrated in Fig. 3, are assumed to be producing the same thrust, but with B having twice the jet velocity of A. Since the thrusts are equal, B will have half the mass flow of A, thrust being the product of mass flow times velocity. Also, the weight flow of B will be half the weight flow of A, since mass flow is equal to weight flow divided by g, the acceleration of gravity.

If it is assumed that the internal combustion machines which energize each of these jets, operate at the same fuel-to-air ratio (i.e., the same mixture strength), then the fuel flow of jet B will be half the fuel flow of jet A. Since the thrusts are equal, the specific fuel consumption will be half as much for jet B as for jet A. Thus for the same thrust and the same mixture strength, the jet with twice the velocity is twice as efficient in terms of fuel used per pound of thrust.

To find the propulsive efficiency for the two jets at an assumed airplane speed of 100 mph, a jet velocity of 1000 fps is assumed for A. Jet B will then have twice the latter, of 2000 fps. Returning to Fig. 1, it can be found from the formulae that the propulsive efficiency of jet A would be 25.5 per cent, and jet B 13.7 per cent. The ratio of the two efficiencies N_{pB} to N_{pA} is therefore 0.535.

Thus, the power plant with twice the jet velocity, has only half the propulsive efficiency, *although it produces the same thrust at the same airplane speed, with only half the fuel consumption.* Clearly, the term "propulsive efficiency" must be used with caution, because its value does not, by itself, properly define the relative merits of two power-plants as means of aircraft propulsion.

What, then, is the justification for the use of the term "propulsive efficiency"? Several arguments have been cited in support of it, as for example the fact that higher jet velocities per se do not necessarily mean that the engine is operating at higher thermal efficiency. Afterburning, or tail pipe fuel injection, is one method of increasing takeoff thrust in a turbojet engine, where the additional thrust is obtained by increasing the jet velocity at the expense of specific fuel consumption, so that thermal efficiency is reduced. In this case it can be properly said that the increased jet velocity has resulted in reduced propulsive efficiency, yet it would seem less confusing merely to note the reduced thermal efficiency and resulting increased specific (*Turn to page* 70, *please*)



This electrosonic tester will register differences in volume capacities of cylinder heads with an accuracy of one part in 1500.

Sonic Vibrations Measure Combustion Chamber Volume

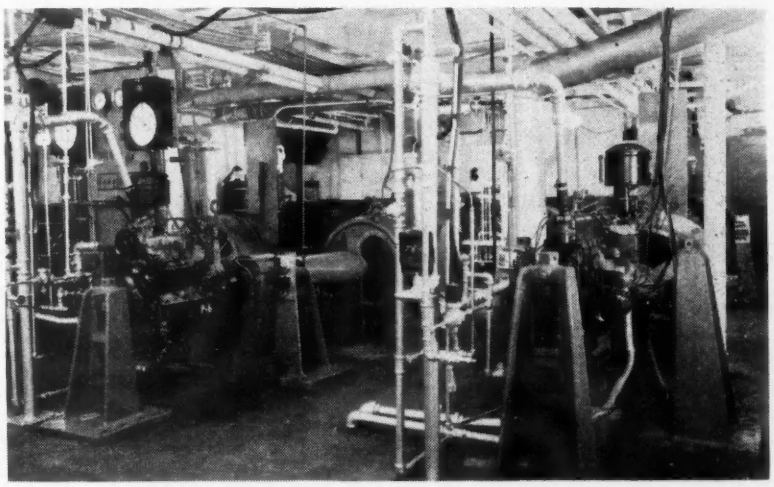
A NEW device called a Cavitometer, is being used on a production basis at the Oldsmobile Division, General Motors Corp., for 100 per cent inspection of cylinder head combustion chambers for the eight-cylinder Oldsmobile engine in the Futuramic Series. The instrument is capable of inspecting cylinder heads at the rate of 150 per hour for eight-cylinder Oldsmobile engines. It is said to register differences in volume capacities within one part in 1500.

Representing one of the most recent advances in the electrosonic field, a comparatively new science, is replacing the older method of measuring the combustion chambers of cylinder heads by pouring a fluid into them and measuring the volume of the fluid. The principle upon which the Cavitometer is based is that all cavities with a certain type of throat opening have a natural frequency at which they will resonate. When the cylinder head is placed in the Cavitometer it reflects a sonic wave that is compared with a master cylinder-head combustion chamber of known sonic frequency. The difference between these two is interpreted in volume measurement and is indicated on a dial.

The cylinder-head combustion chambers are measured automatically in sequence. If any of them is "out of volume" this fact is indicated on the dial above it and operation of the machine is interrupted so that the operator may make note of it. The head may then be classified for repair or rejection.

Although use of the Cavitometer is limited at Oldsmobile at the present time to the eight-cylinder high-compression head it has demonstrated its worth and will be used more extensively in the future, according to the Oldsmobile management.

Cylinder Wear Studied in New Laboratory



A section of the new automatically controlled laboratory at the National Bureau of Standards for the study of engine wear. Two of five test engines are shown connected to electric dynamometers for maintenance of uniform load.

A NEW laboratory for the study of automotive engine performance has been installed at the National Bureau of Standards. Equipped with completely automatic controls, this laboratory offers a means of closely simulating actual operating conditions in such a way that tests can be reliably duplicated. While designed primarily for investigations of cylinder wear, the new equipment may also be used in studying the effects of various types of fuels and lubricating oils on pistons, piston rings, bearings, and carburetors. A problem under investigation at the present time is the determination of the amount of sulfur that can be tolerated in gasolines without appreciably increasing wear.

The automatic test equipment utilizes a battery of five engines from three popular makes of automobiles. Each engine is complete except for fan, radiator, and muffler, and is coupled to an electric dynamometer. The extent of cylinder wear is determined by use of the McKee Wear Gage.

To obtain data that are valid for actual service, the engines, under the control of a master clock, are put through an operating cycle which provides conditions corresponding to cold starting, warm-up, speed-up, idling, stopping, and cooling. A central panel for automatic timing and control has been installed to permit simultaneous cyclical operation of the five test engines. Installation of an automatic multiple thermograph to record continuously the temperatures of all engines is planned.

M-55—Machine Faces Block Assemblies

The Cross Co., Detroit, Mich., announces a special machine tool for facing cylinder block assemblies, which finishes the transmission joint face square with the crankshaft bore at the rate of 56 per hr.

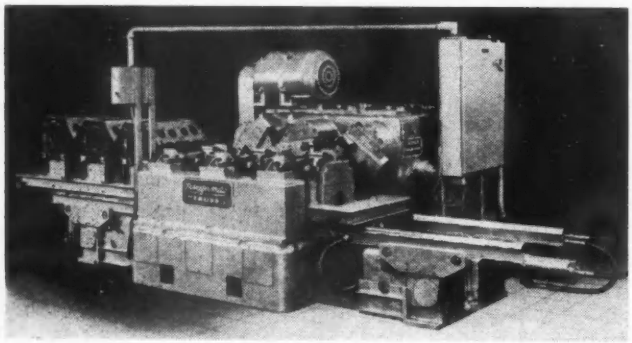
Because parts are handled in multiples by a transfer mechanism, and because three blocks are faced at the same time, production costs are claimed reduced and output per man hour increased. Only one operator is required and he need be less skilled than formerly, it is said. No lifting of parts is necessary since the blocks slide in and out of the machine on a conveyor with the help of an automatic power transfer mechanism. Locating and clamping are also automatic.

Single point carbide facing tools assure accuracy, reduce heat at the cutting point and eliminate unnecessary strains. Hydraulic valves are gasket mounted and conveniently located.

This Transfer-matic—Cross's name for its special machine tools equipped with automatic transfer mechanisms—can be expanded to include other operations. Machines can be added for precision-boring the locating holes of the transmission, or finish facing the crankshaft thrust faces.

NEW Production and Plant EQUIPMENT

For additional information regarding any of these items, please use coupon on page 58



Cross special machine for facing cylinder block assemblies

M-56—One Step Welding Press

Clearing Machine Corp., Chicago, Ill., has developed a spot welding press claimed capable of handling large, complicated sections, eliminating costly manual labor, and performing the welding job in one step. Moreover, several welds can be done at the same time. Actuated by a toggle link mechanism, an "up" moving platen with four point suspension brings the work to the electrodes.

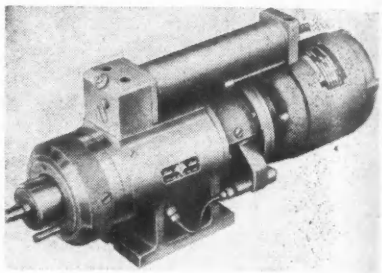
The welding operation is automatically controlled from a special panel. Each time the press reaches the top of the stroke, a contact on this control panel energizes the automatic welding panel. This welding panel then takes over and causes the actual welding process to be performed in the required sequence with the necessary timing while the press dwells in a closed position. At the end of the welding operation, a contact on the welding panel transfers control back to the press control panel, which immediately allows the platen to return to its open position, completing the operational cycle.

Parallelism between the platen and the bed is achieved with four adjusting brackets, one located in each corner, and the platen is guided by four individual gibs which also are adjustable. A single geared V-belt drive with air friction clutch is mounted on top of the press.

Clearing spot welding press for complicated sections

M-57—Hydraulic Drill Unit

Production drilling can be done in any position, angle or plane by a new air-hydraulically operated power unit recently developed by Cleveland Republic Tool Corp., Cleveland, Ohio. The drill unit, made in two models, can be used as a single unit or combined with several for simultaneous operations. One model, the 250, can be used to drill ¼ in. in steel, while the other, the 500, is suitable for drilling ½ in. in steel. The units may be used not only for drilling, but also for milling, riveting, chamfering, slot sawing and spot facing.



Cleveland air-hydraulic drill unit

Both units feature rapid approach and variable feed which allows the tool to come within 0.001 in. of the work. At this point the work feed automatically cuts in smoothly and without hesi-

For SAFE FOOTING

Truck and Bus Operators Prefer

Inland

4-Way Floor Plate

Operators of trucks and buses know how slip-resistant Inland 4-Way Floor Plate protects drivers and passengers from dangerous falls. That's why more and more owners are buying vehicles equipped with this modern safety floor plate. Realizing this demand, more and more manufacturers and body builders are making 4-Way Floor Plate standard equipment on many of their models. In addition to safe footing, this flooring provides the full strength of structural steel, easy fabrication, attractive appearance—plus years and years of maintenance-free service. To find out how Inland 4-Way Floor Plate can provide economical protection against slipping in the trucks or buses you build, write for complete information. INLAND STEEL COMPANY, 38 S. Dearborn St., Chicago, Ill. Sales Offices: Chicago, Davenport, Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul.

INLAND STEEL

INLAND 4-WAY FLOOR PLATE

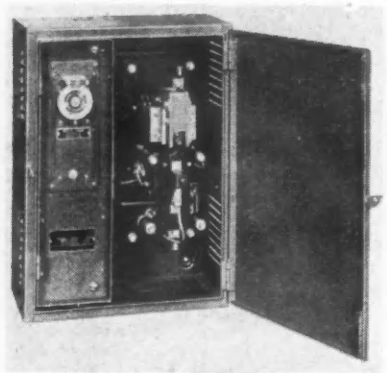
tation. Each drill unit also includes a micrometer adjustment and lock screw to control depth of drilling, countersinking and chamfering to tolerances of less than 0.001 in.

Motor and operating mechanism are totally enclosed, preventing entry of dirt, chips or coolant. Only four moving parts are incorporated in each drill unit, working in a bath of oil. Ample bearing support to the spindle enables it to hold runouts to 0.0005 in. Units can be provided with hand, foot, semi-automatic or fully automatic controls. The power units may be attached to present machines by brackets.

M-58—Combination Welder Controller

The new class 8992 Type BBG-1 combination welder controller developed by the Square D Co., Milwaukee, Wis., provides complete electrical control for a small foot or motor operated resistance welding machine. The single enclosure contains a NEMA 1A pneumatic weld timer, a size 1W, 100 amp high speed magnetic welder contactor, and a control transformer.

For operator safety the initiating switch and control circuits operate at 110 volts isolated from the power supply. The timer is mounted on a Safront swingout panel with adjusting dial on the front and all energized parts in the rear.



Square D combination welder controller

Controllers permit either common or separate control supply connections. A dual primary control transformer may be connected for 110, 220 or 440 volts 60 cycles, or for 380 volts 50 cycles.

M-59—Transfer Machine for Manifolds

A new Transfer Type machine has been designed and built by Snyder Tool & Engineering Co., Detroit, Mich., to complete in a work-cycle of 48 seconds 57 holes on faces on an automatic intake manifold. The machine has one loading station, 11 work stations and one unload station, 13 stations in all. Parts are indexed from station to station by a hydraulically actuated shuttle. Loading fixture, the 11 work fixtures and the unloading fixture are mounted on the machine bed which is made in five sections, cross-keyed and bolted together. Hydraulic piping and wiring is provided with junctions so that the machine can be moved in five sections and readily reconnected. Bed and columns are welded steel, normalized and ribbed for rigidity.

The machine is equipped with six Snyder standard self-contained hydraulic units which carry multiple heads and bushing plates, two Snyder standard slide units and one Snyder standard tapping unit with multiple spindle head. In addition, three special slides are equipped with multiple heads. These units, slides and heads are mounted on risers and columns at various angles as required.

The part is moved into the loading station and manually positioned by the operator. Pressing the starter button automatically indexes the part into the first work station where locators register on locating spots cast on the part at the foundry. At this station, two flange holes are drilled and sized with subland drills and are thereafter used for locating the part in the remaining 10 work-holding fixtures. At the last work station, two holes are drilled and tapped. The tapping head is mounted on a vertical slide and is raised vertically away from the part. When the drilling head for the two end holes moves into position to drill the holes it is directly beneath the tapping head and this same movement moves the previously machined part from the last work station over to the unload mechanism where it is discharged from the machine.

NEW
Production and Plant
EQUIPMENT

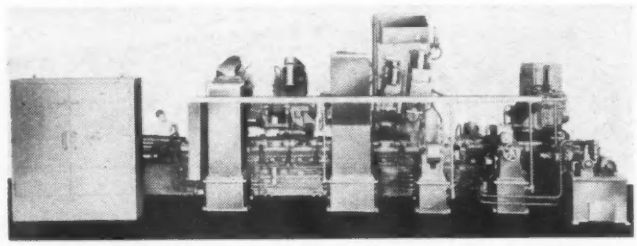
For additional information regarding any of these items, please use coupon on page 58

M-60—Press for Powdered Metal Parts

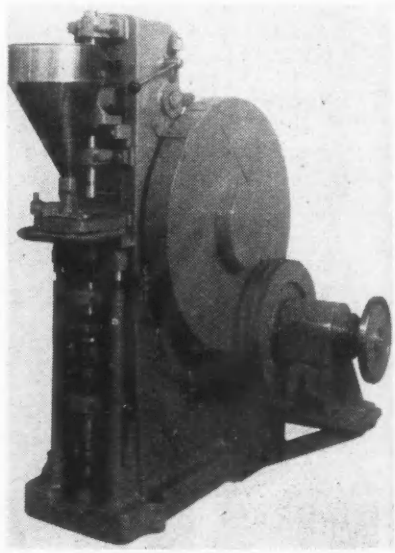
Just introduced by F. J. Stokes Machine Co., Phila., Pa., is a new 12-ton capacity press, designed for high-speed economical production of powdered metal parts, including porous bearings, alnico, cemented carbides, iron cores, thin-walled bushings, blind end bearings, parts with concentric projections, hemispherical shapes, flanged bearings, high-bronze bushings, as well as ceramic parts and carbon mixtures.

Identified as the G-4 press, it is built of meehanite, and is capable of applying pressures up to 12 tons simultaneously from both top to bottom. Built into the machine is a movable core rod which can be arranged to drop before the die is filled and then automatically push up from below to assure uniform distribution and a full die cavity before pressure is applied. This core rod can be locked in position to serve as a stationary core rod, capable of withstanding the full 12 tons pressure. The press can be operated with a compound or secondary lower punch, adjustable for stroke or pressure, by a simple cam change.

Maximum die fill is 4 in.; maximum diameter of piece that can be produced is 2¼ in. The press is powered with a 3-hp variable speed unit drive, provided with a lever-operated clutch and brake.



Snyder transfer type machine for operations on automatic intake manifolds



F. J. Stokes 12-ton G-4 press

Essential

. . . for Leak-Proof, Pressure-Tight Automobile Assemblies!

All three Permatex Form-A-Gasket Sealing Compounds make every type of assembly leak-proof and pressure-tight . . . be it threaded, flat or flanged. They all prevent corrosion and are leak-proof to gasoline, fuel oils, lubricating oils, hot or cold water, all types of anti-freeze and numerous other liquids and gases. Use the one that best fits the job.

Permatex Form-A-Gasket No. 1 (a paste) dries fast and sets hard, but never becomes brittle. Makes tough, permanent unions even with warped or pitted surfaces.

Permatex Form-A-Gasket No. 2 (a paste) sets slower than No. 1. Dries to a tough, pliable film with plenty of "cushion" to absorb continual vibrations . . . yet disassembles easily.

Permatex Aviation Form-A-Gasket No. 3 (a brushable liquid) quickly dries to a tacky paste. Since it acts as a lubricant before it seals, threaded connections can be tightened up all the way without binding. Unions are easily disassembled. Will not run at 400° above nor become brittle at 70° below.

May Be Used With or Without Old or New Gaskets

Order Through Your Auto Supply House

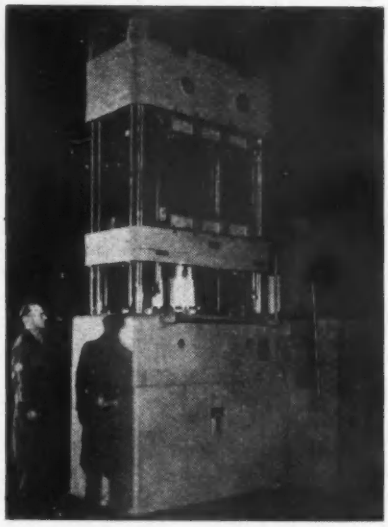
We Invite Your Further Inquiry

PERMATEX COMPANY, INC. BROOKLYN 29, N. Y.

NEW Production and Plant EQUIPMENT

For additional information regarding any of these items, please use coupon on page 58

M-61—Plastics Molding Press



Hydraulic plastics molding press

A large compression semi-automatic plastics molding press recently built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has a pressure capacity of 500 tons, maximum mold size of 42 by 36 in., daylight between platen and head of 54 in., and maximum ram travel of 26 in.

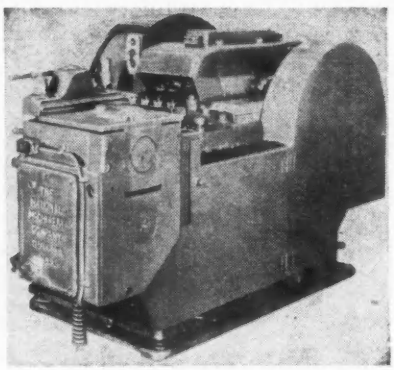
A large upward acting hydraulic ram is fitted with a small internal booster ram, providing high speed closing up to 320 in. per minute. Automatic slowdown is provided prior to mold contact, the slow closing speed being adjustable. The press opens rapidly at speeds up to 108 in. per minute.

The press also features an automatic breathing or degassing cycle for optional use. It is equipped with an HPM Hydro Power variable delivery, radial piston type hydraulic pump, with 25-hp direct electric motor drive through flexible coupling.

M-62—Cold Nut Former

Cold nut formers capable of producing a greater variety of high quality hex nut blanks than is possible with other machines of this type, are now being manufactured in volume by the National Machinery Co., Tiffin, Ohio. Standard single and double chamfered nuts, washer faced nuts, castellated nuts, hug lock nuts, Marsden lock nuts and jam nuts have all been produced on these machines.

Similar to a transfer header in design, the National cold nut former utilizes a new principle of operation. Only a minimum of cold forging is done on the blanks until the later operations. Hence, internal stresses caused by early work hardening are avoided, and the finished blanks have typical forging strength and toughness.



Cold nut former offered by the National Machinery Co.

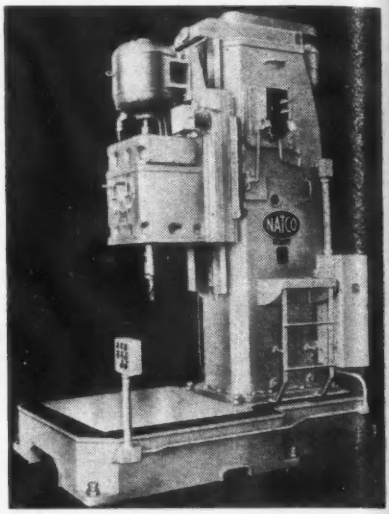
Machine features include a short rigid bed frame, overarm heading slide, automatic lubrication and a four transfer mechanism which turns the nut blanks 180 deg. after each stroke. All operations—gathering, blanking, forming and punching—are carried on simultaneously, the former producing a complete nut on each stroke.

Because the blanks are cold forged to shape, with most of the material from the hold entering the nut, the only waste is a small slug from the hole. Scrap loss is said to be held between 10 and 15 per cent.

The machines are built in 5/16 in., ⅜ in., ½ in., ⅝ in., ¾ in. and 1-in.. sizes. Outputs range from 100 nuts a minute on the 5/16-in. size to 40 a minute on the 1-in. size.

M-63—Hydraulic Drill Tester

A new Natco heavy duty hydraulic drilling machine has just been developed by The National Automatic Tool Co., Richmond, Ind., to test the life of drills. Designed to operate at peak efficiency under abnormal or overload conditions, and to meet unusual stresses and loads at various speeds, the machine is equipped with a heavy duty single 7-speed geared head. The 30 hp motor maintains a synchronous speed up to the rated hp when the drills become dull.

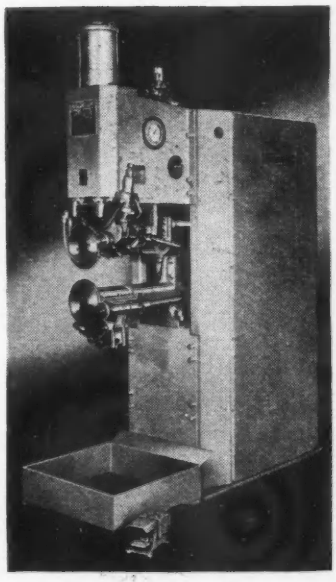


Natco machine tests life of drills

As the load builds up to a predetermined value a torque limiting device operates to stop the motor. A shear pin arrangement is also provided to prevent destruction of gears in the head in the event of serious overloading. A range of 42 different speeds is possible through change gears.

M-64—Roller Head Seam Welder

A complete new line of roller-head seam welders has been put out by Progressive Welder Co., Detroit, Mich., comprising three basic sizes—light, medium, and heavy duty. Each size is available in three types—for circular welding, for longitudinal welding, or for both circular and longitudinal welding.



Progressive roller head seam welder

This ring champion goes on and on!

Some ring champions retire, but Sealed Power goes steadily forward. Sealed Power factories, laboratories and staff, working hand-in-glove with the automotive industry since 1911, are now at the highest peak of their 37-year history. You are urged to use Sealed Power facilities to help make your good engines even better.

SEALED POWER CORPORATION
MUSKEGON, MICHIGAN — IN CANADA: STRATFORD, ONTARIO

Sealed Power

PISTON RINGS · PISTONS
CYLINDER SLEEVES

The head is completely guided and aligned by four sets of anti-friction rollers, insuring that welding wheels follow up and down even extremely small deviations in material thickness and contour for the maintaining of constant weld-pressure. The rollers are matched in pairs, adjustable pre-loaded, and guide the head the full length of its vertical travel, riding on positive alignment V-guides on hardened and ground ways.

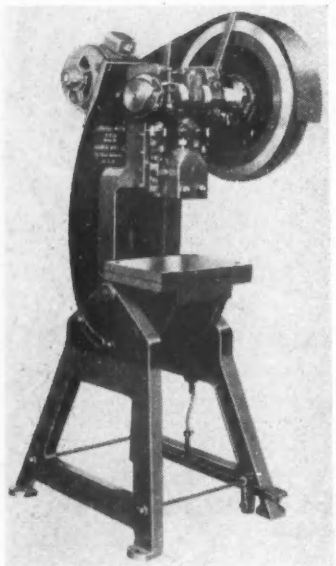
The seam welders may be used either for continuous, water or gas tight seam welding, or for roll-spot welding. They may also be used for cold-rolled, stainless, or other alloy steels; aluminum and other non-ferrous alloys, and for various types of coated metals.

NEW Production and Plant EQUIPMENT

For additional information regarding any of these items, please use coupon on page 58

M-65—Improved Press Line

The Sales Service Machine Tool Co., St. Paul, Minn., announces improvement of their entire line of Press-Rite presses and the addition of a new 12-ton press. All of the presses except the



Press-Rite press

No. 0 press are now built with anti-friction roller bearings in the flywheels. Flywheel weights have been equalized. A new positive single-stroke clutch, together with an automatic brake, are included as standard equipment.

The clutch dog engages into a 4-point steel ring attached to the flywheel. The clutch engaging and disengaging pawl operates by a built-in cam in the crank drive integral collar. This cam revolves with the crank and when the clutch is tripped by a foot treadle or any other engaging mechanism, the disengaging pawl is locked in a positive position until the clutch dog is completely disengaged out of the clutch drive ring. The clutch treadle must be completely released to an upward position before the clutch can be tripped for next stroke.

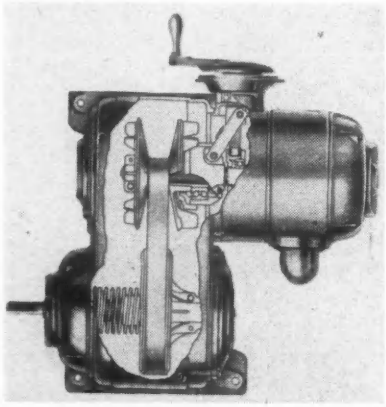
There is only one spring in the entire clutch mechanism. This spring engages the clutch dog into the clutch drive ring. Should the spring fail, the dog would not engage into the clutch drive ring until the spring was either corrected or replaced—which requires only a few minutes. The clutch can be used either for continuous operation with automatic feeds or as a single stroke clutch.

M-66—Vari-Drive Motors

Accurate, non-fluctuating speeds over a wide range are instantly available with the Type VEV-GD single reduction Vari-drive motor placed on the market by the U. S. Electrical Motors, Inc., Los Angeles, Cal. Greater production can be obtained by adjusting to changing needs without stopping the machine.

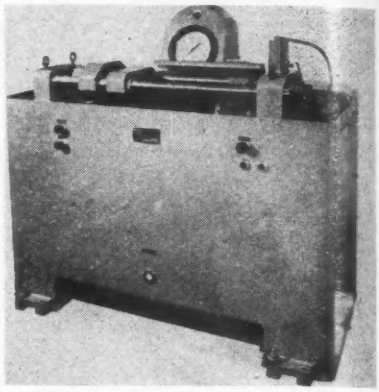
A one-piece, flexible Varibelt transmits power smoothly and absorbs load shocks and vibration, aided by a belt tensioner which eliminates slippage regardless of load. Permanent alignment of parts is insured by normalized castings. There are no electrical contacts or brushes to be replaced. An enclosed, drip-proof housing protects against falling objects. Horizontal or upright models with speeds from 1 to 10,000 rpm are available from ¼ to 50 hp. Speed ratings range up to 7 to 1.

All operating parts are amply lubricated with liberal use of ball bearings to reduce friction.



Vari-drive motor, Type VEV-GD manufactured by U. S. Electrical Motors, Inc.

M-67—Hydrostatic Tube Tester



Steel City hydrostatic testing machine

A hydrostatic testing machine for pressures up to 20,000 psi has been designed and manufactured by Steel City Testing Machines, Inc., Detroit, Mich., for pressure testing of tubing. The machine seals the end of tubing without any perceptible flare, eliminates air and builds up to the required pressure. For a predetermined time cycle it holds the pressure and then automatically reverses and is ready for the next test. The pressure gage can be disconnected during the test—peak test pressure being indicated by a red light on the panel. Time cycle for load and unload is approximately four seconds. The equipment consists of hydraulic pump and motor, electrical timers and switches, and solenoids, relays and valves. Of one piece steel construction, the electrical panel is integral with the base. The unit occupies a floor area of 15 sq ft and an overall height of 5 ft.

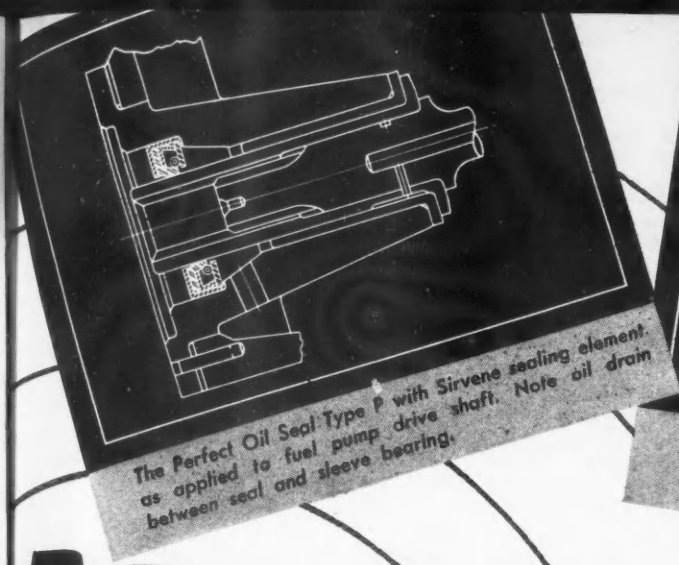
M-68—Hydro-Steam Cleaning Unit

An improved Turco Hydro-Steam cleaning unit is now available from Turco Products, Inc., Los Angeles, Calif. It incorporates, in a simple unit, features usually found only in expensive self-fired chemical spray cleaning machines.

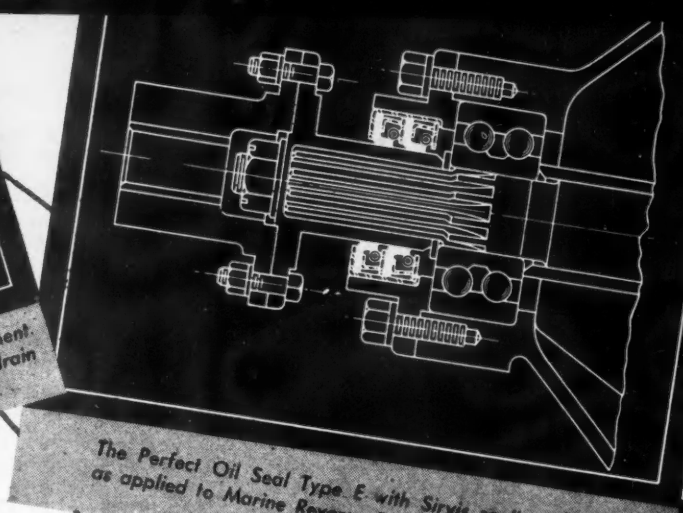
The unit is said to afford a simple mechanical means of utilizing existing steam to supply the proper amount of cleaning solution in a regulated steam flow where it is mixed and delivered through a single hose to a cleaning gun.

Practical wherever a steam line pressure of 80 to 150 lb is available, the unit weighs only 28 lb, is easily portable, and may be quickly disconnected for removal to other parts of a plant.

(*Turn to page 98, please*)



The Perfect Oil Seal Type P with Sirvene sealing element as applied to fuel pump drive shaft. Note oil drain between seal and sleeve bearing.



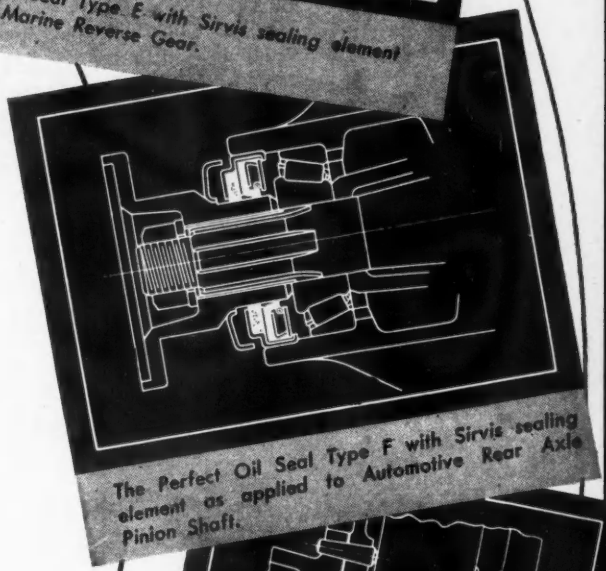
The Perfect Oil Seal Type E with Sirvis sealing element as applied to Marine Reverse Gear.

PERFECT *Oil Seals* HAVE A *Wide Range* OF USEFULNESS

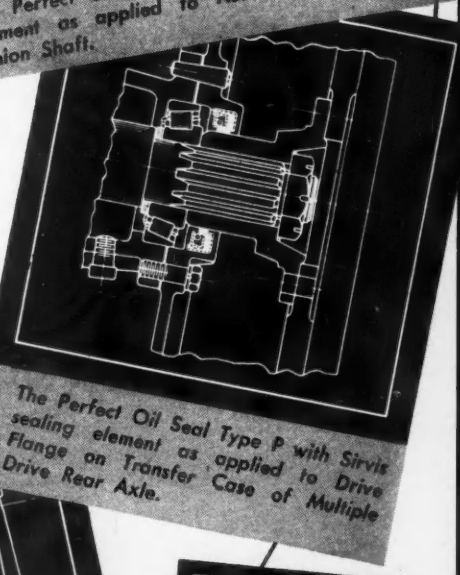
Perfect Oil Seals are used to prevent lubricant leakage and protect bearings and machines throughout the industrial and automotive world.

There Are 16 Types of Perfect Oil Seals, each of which has from one to six variations so that practically all sealing problems can be adequately handled. More than 1800 sizes are available. Shown here are a few typical applications.

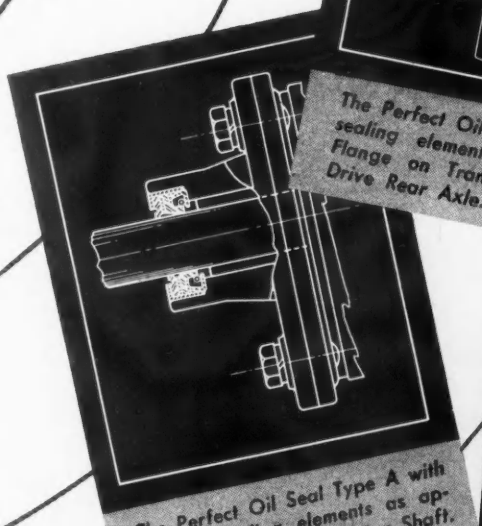
For Full Information on types, sizes and specifications, write for "Engineering with Perfect Oil Seals" which has recently been published.



The Perfect Oil Seal Type F with Sirvis sealing element as applied to Automotive Rear Axle Pinion Shaft.



The Perfect Oil Seal Type P with Sirvis sealing element as applied to Drive Flange on Transfer Case of Multiple Drive Rear Axle.



The Perfect Oil Seal Type A with Sirvene sealing elements as applied to Bilge Pump Rotor Shaft.

OUR **70TH** YEAR OF INDUSTRIAL SERVICE

5735

PERFECT *Oil Seals*

CHICAGO RAWHIDE MANUFACTURING CO.

1310 ELSTON AVE. • CHICAGO 22, ILLINOIS

Manufactured and distributed in Canada by Super Oil Seal Mfg. Co., Ltd., Hamilton, Ontario

OTHER C/R PRODUCTS
sirvis MECHANICAL LEATHER
SIRVENE SYNTHETIC RUBBER

NEW YORK • PHILADELPHIA • DETROIT • LOS ANGELES • CLEVELAND • BOSTON • PITTSBURGH • SAN FRANCISCO • MINNEAPOLIS • CINCINNATI • HOUSTON • DENVER • SYRACUSE • PEORIA

PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE INDUSTRIES. In making requests please be sure to give the NUMBER of the item concerning the publication desired, your name and address, company connection and title.

L-74—Clutches

Morse Chain Co.—The Morse-Formsprag Full Complement Over-Running Clutch, its construction, development and working principle are described in a new, 16-page, 2-color catalog. It gives engineering diagrams of special designs at work with the clutch integrated within the designs.

L-75—Surface Grinders

Thompson Grinder Co.—To facilitate the selection of all sizes of Hydraulic Surface Grinders and other machines, a 32-page book has been prepared which contains all specification data and description. The book is illustrated and indexed for quick reference. It contains facts on crush form grinding and actual case histories of Thompson Truforming.

L-76—Fuel Oil Additives

E. F. Houghton & Co.—A new pamphlet on fuel oil additives, which contains a description of the Houghto-Solv, has been released. The folder gives detailed information on how to use the product, how it works and where best to use it.

L-77—Press Brake Dies

Verson Allsteel Press Co.—Verson Die Manual, a handbook of press brake dies, punching attachments and press brakes is the title of an attractive new 88-page book. Approximately 200 press brake dies are illustrated and described. Related die types are grouped together with descriptive text discussing their uses and advantages and limitations. Useful engineering data for making metal forming calculations and complete details and specifications on Verson Press Brakes are included.

L-78—Baskets, Hampers, Trucks

C. R. Daniels, Inc.—A handy pocket-size booklet, describes the company's baskets, hampers and trucks. The various types produced for use in automotive parts manufacturing plants are illustrated and described and specifications are given.

L-79—Circulating Pumps

Allis-Chalmers Mfg. Co.—The company's foot mounted, submerged and side-wall mounted coolant circulating pumps are described in a new 8-page bulletin. Construction details and application information is supplied for each of the eight types, together with dimensions, head capacity, motor frame, pipe friction, etc.

L-80—Instruments and Controls

Electro-Tech Equipment Co.—Catalog No. 48 is a comprehensive buyers' guide of instruments and controls. It is divided into six sections covering laboratory and portable test instruments, panel and switchboard instruments, pyrometers and associated equipment, service instruments, transformers, rectifiers, controls and miscellaneous equipment.

L-81—Fuel System

Cummins Engine Co., Inc.—Bulletin 5275, The Exclusive Cummins Fuel System, is a non-technical description of the system of fuel delivery and injection used in Cummins Diesel engines. It lists the advantages of the Cummins system in terms of engine performance.

L-82—Diesel Performance

Cummins Engine Co., Inc.—On-the-job Performance, Bulletin 5276, describes the application of Cummins Dependable Diesels to trucks, shovels, earthmovers and other equipment used

(*Turn to page 76, please*)

TIME SAVER COUPON for your convenience in obtaining, WITHOUT OBLIGATION, more information on any one or more of the publications described above OR New Production and Plant Equipment OR New Products items described on other pages.

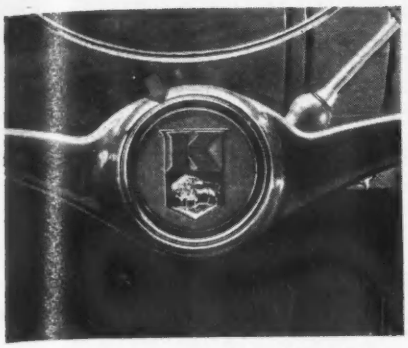
Readers' Service Department,
Automotive Industries,
Chestnut & 56th Sts., Philadelphia 39, Pa.

Please send me: **These FREE Publications** (Use letter and designating number of each item desired)	*Please send me more information on:* **New Production and Plant Equipment** (Use letter and designating number of each item desired)	*Please send me more information on:* **New Products** (Use letter and designating number of each item desired)
....	....	....
....	....	....

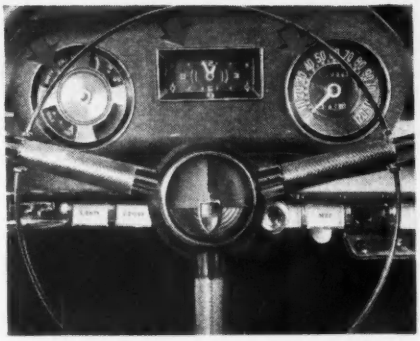
Your Name ..... Your Title .....

Your Company Connection or Business .....

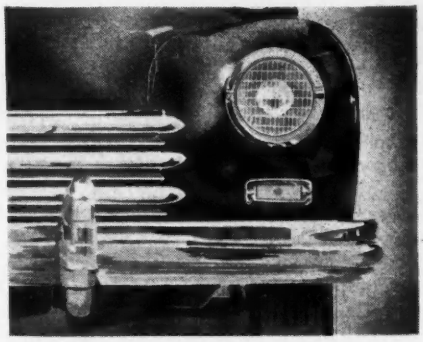
Address .....
(Street & No.) (City) (Zone) (State)



Horn button of sparkling "Lucite" in beautiful three-dimensional colors. Horn buttons of "Lucite" are used on 15 makes of cars. (Horn button molded by Kent Plastics Corp., Evansville, Ind.)



Instrument dials of crystal-clear "Lucite." Luxurious styling in practical use. Highly visible, highly durable. Dials of "Lucite" are used on 11 makes of cars. (Dials molded by Cruver Mfg. Co., Chicago.)



Headlamp and parking lamp lenses of "Lucite." Transmits up to 92% of light, resists shattering, cracking, crazing. An interesting MICRO-STYLING possibility for weather-resistant "Lucite."

Right in line with Smart design

MICRO*STYLING with "LUCITE"

The time-tested plastic (since 1937)—
Now in 99 parts on 17 makes of cars

***MICRO-STYLING** is the design of small but important automobile accessories for beauty and utility. A handsome hood ornament . . . a sparkling tail-light lens . . . a door handle with the luxury look and feel . . . a host of little things will impress the customer. MICRO-STYLING can help sell and *re-sell* your cars to buyers who are becoming more and more style-conscious. Your MICRO-STYLING calls for the best in quality materials . . . Du Pont "Lucite."

THESE advantages make "Lucite" acrylic resin your wisest investment for MICRO-STYLING.

LONG-LASTING COLOR—"Lucite" comes in a wide range of color-fast hues, transparent, translucent and opaque. Proved in use since 1937, "Lucite" holds its beauty through years of weathering and hard service.

SPARKLING TRANSPARENCY—Smartly designed lenses, dial faces, etc., of crystal-clear "Lucite" transmit up to 92% of light. "Lucite" can be "edge-lighted," and will "pipe" light around curves.

LUXURIOUS SMOOTHNESS—You'll notice right away the smooth, warm look and feel of knobs and handles made of "Lucite." It withstands hard knocks . . . it's not brittle.

OUTSTANDING DURABILITY—Pieces made of "Lucite" last for years and years . . . retain full beauty and utility even in exposed parts. The weather-resistance of "Lucite" is unsurpassed by any transparent plastic. In normal use, it is not damaged by gasoline, lubricants, or by many common solvents that cause crazing in less durable plastics. And "Lucite" is readily molded and machined.

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

You'll find "Lucite" is *the* practical plastic for giving your car all-important MICRO-STYLING. That's why 17 of today's most wanted makes of cars use 99 parts molded of "Lucite."

WRITE FOR FREE INFORMATION on "Lucite" and other Du Pont plastics. No obligation. If you wish, Du Pont technical men will be glad to consult with you in confidence and advise on applications of DuPont plastics to help your MICRO-STYLING plans. Address E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room 209, Arlington, N. J.

NEW ★ PRODUCTS

For additional information regarding any of these items, please use coupon on page 58

P-54—New Type Torsion Machine

The first of a new type of torsion machine developed by Baldwin Locomotive Works, Phila., has been installed by Mack Trucks, Inc., in its research laboratory, Plainfield, N. J., to test axle shafts, crankshafts, and frame and body members of buses and trucks that are subjected to torsional stresses in service. Mack engineers will use these tests to select suitable steels and alloys, to determine best heat treatments, and in general to guide design of trucks and bus parts.

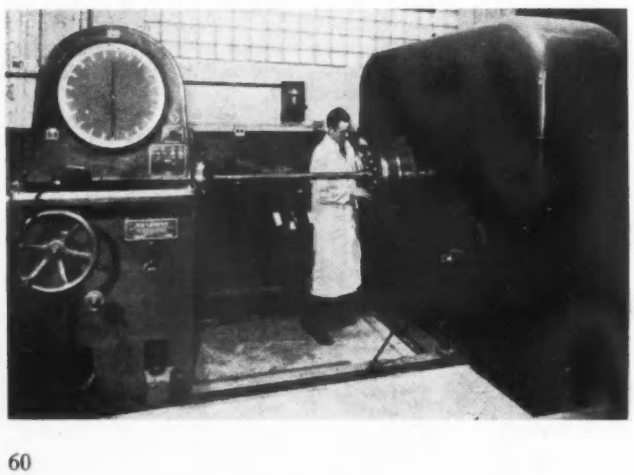
In some torsion tests local stresses in crank shafts, body and frame members will be indicated and measured by Stresscoat and SR-4 bonded resistance wire strain gages, particularly in fillets and other points where excessive stress concentration must be prevented. A recorder, producing curves of torque versus angle of twist, will be mounted on the indicator cabinet for many tests.

The Mack torsion machine has a maximum capacity of 1,000,000 in. lb., and is large enough to test bars or tubes up to 10 ft. long and 6 in. dia. It consists of a rigid base frame, a drive head at one end and a weighing head that travels on two racks and tracks on the base frame and can be clamped to the base.

The weighing head measures torsional loads in either direction of rotation. The drive head is powered by an electronically controlled, variable speed, direct current motor with a 20 to 1 speed range. By means of two gear ratios, however, spindle speed can be varied between 1 and 20 degrees per minute and between 20 and 400 degrees per minute, giving a loading speed range of 1 to 400 degrees per minute. Angular measurements can be read to 0.1 degree by a vernier on the chuck at the power end.

Torsional loads are applied in the weighing head to the well-known Emery capsul. A standard Tate-Emery indicator takes the hydraulic pressure in a Bourdon tube that is restrained from deflecting by a pneumatic system sensitive to the air pressure changes that occur when the Bourdon tube disturbs a baffle plate over an air jet. A pressure sensitive bellows in the pneumatic system restrains deflection of the baffle and Bourbon tube through an iso-elastic spring and thereby activates the indicator hand with the resulting extension of the spring.

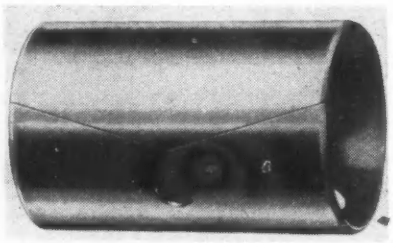
Four load ranges are available for torsional tests: 10,000; 50,000; 200,000; and 1,000,000 in. lb. On each range accuracy claimed is ½ per cent.



Baldwin torsion machine tests axle and crankshafts and frame and body members of Mack buses and trucks

P-55—V-Seam Piston Pin Bushing

A V-seam piston pin bushing is announced by Federal-Mogul Service, Div. of Federal-Mogul Corp., Coldwater, Mich., manufacturers of engine bearings. Feature of the new bushing is a V-seam, incorporated as the bushing is rolled from strip bronze.

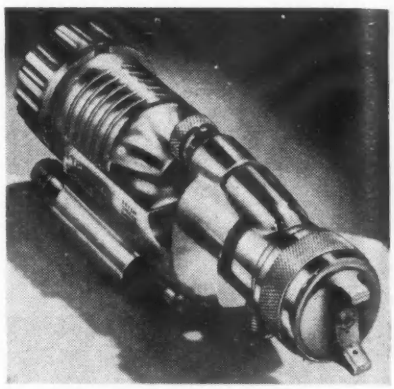


Federal-Mogul V-seam piston pin bushing

The V-seam design permits an easy starting "bite" by the reamer when bringing it to final pin-fit size. This eliminates the danger of bushing roll-up on the reamer and also the need for special reaming equipment.

The new bushing also features chamfered ends that permit even, accurate entry of the bushing into the piston-pin hole, without distortion of the bushing. Prepunched oil holes eliminate difficult after-installation oil-hole drilling and possibility of burring. Ream stock of 0.0025 in. to 0.0035 in. is left on the bushing wall for cleaning it up to final pin-fit size.

P-56—Automatic Spray Gun



DeVilbiss AGA automatic spray gun

A new AGA gun has been originated by The DeVilbiss Co., Toledo, Ohio, for a faster acting automatic spray gun of greater capacity and simpler controls. Adaptable to any type spray finishing machine, the gun is only 7 in. long, 2¾ lb in wgt, and can be supplied with mounting adapters for tipping and turning to any position.

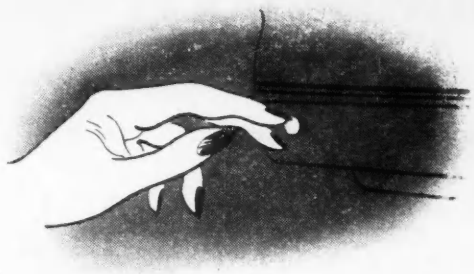
The lightning fast action allows the gun to open—spray—and completely close 5400 times per hr. It is controlled entirely by an air operated piston, which improvement provides positive, leak-proof shut-off of fluid and air at the end of each spraying cycle.

All types of materials can be sprayed. The gun is adaptable to the most delicate or the heaviest types of product finishing. The same wide range of air caps and fluid tips used with the DeVilbiss MBC hand spray gun are interchangeable on the AGA gun.

P-57—Silicon Bronze Welding Electrode

Immediate availability of a new silicon bronze electrode for welding silicon bronze base metals and copper, and for joining galvanized iron and silicon bronze to steel, has been announced by Air Reduction Sales Co., New York, N. Y. To be used in the manufacture of chemical processing equipment, hot water tanks, etc., the new electrode is available in 5 diameters ranging from 3/32 in. to ¼ in. and varying in length from 11 to 18 in.

PUSH-BUTTON STARTING



COSTS LESS!

with the Bendix STARTER Drive

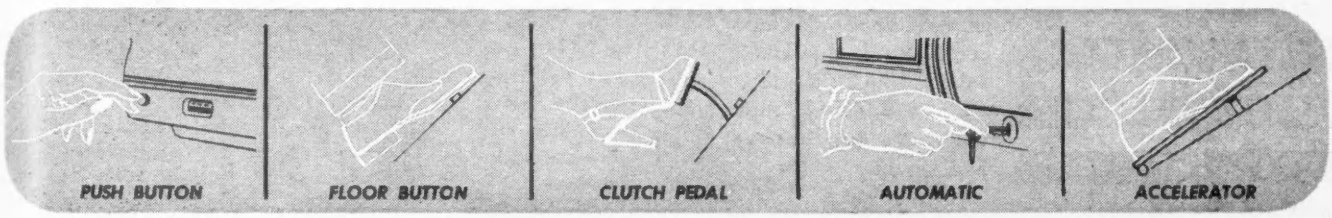
PREFERRED FOR THE FINEST CARS . . .

USED BY TWO OF THE THREE LEADING QUANTITY PRODUCERS!

Every day more and more people are enjoying the ease and convenience of push-button starting. As a result of this ever-growing popularity, they are learning to look for this feature when buying an automobile. You can add push-button starting to your car with the Bendix* Starter Drive. It's the best proved drive in the industry—with a record of over 70,000,000 installations. Equally important is the fact that, with the Bendix Starter Drive, you get the recognized selling advantages of push-button starting *at the lowest possible cost.* Investigate the many advantages of the versatile Bendix Starter Drive. Your inquiries are invited.

*REG. U. S. PAT. OFFICE

NO MATTER WHAT TYPE OF STARTING YOU SELECT—YOU CAN DO IT BETTER—DO IT FOR LESS WITH BENDIX DRIVE!



ECLIPSE MACHINE DIVISION *of*
ELMIRA, N. Y.
Detroit Office: 8-212 General Motors Bldg.

Bendix
AVIATION CORPORATION

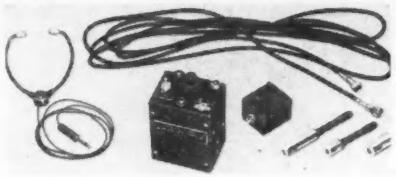
NEW PRODUCTS

(*Continued from page* 60)

P-58—Engine Knock Determinator

For use on the road or in the laboratory, the Erdco Knockophone presented by the Engineering Research & Development Co, Hinsdale, Ill., provides a means of accurate, aural knock determination with complete operator comfort.

The Knockophone consists of a vibration pickup, cable, amplifier case, and stethoscope-type earphones. The pickup is mounted on a cylinder-head stud or cap screw and connected by a ten-foot cable to the amplifier case, the entire installation requiring three minutes. The amplifier case contains a three-stage subminiature amplifier, filter circuit, power supply, two switches, and a volume control. Because the earphones effectively exclude road and vehicle noise, windows may be left open; vehicles with a high noise level, or rear-engine buses, become subject to normal road test procedures. The operator's eyes and hands remain free to observe, record, and make adjustments to other equipment.

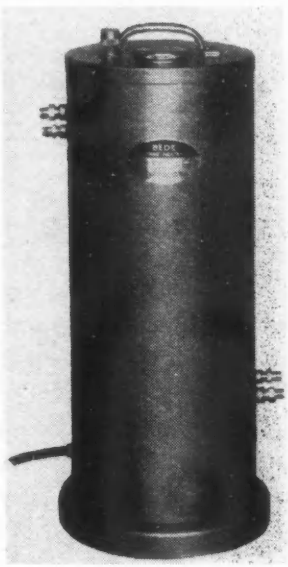


Erdco Knockophone

By adhering to the primary standard of knock evaluation, i.e., the ear, ratings may be made by any procedure; the knock intensity may be adjusted to any desired value. The filter, which may be turned on or off, substantially eliminates all mechanical engine noise, allowing only the knock frequencies to reach the ear. With the filter off, total engine noise is heard, allowing use of the unit for engine analysis. Electrical interference is nonexistent.

P-59—Hot-Spray Paint Process

A new hot-spray painting process, the Bede complete thermal control system, is now being introduced to the paint finishing industry by Bede Products, Inc., Cleveland, Ohio. This basically new process uses heat to create optimum spray painting conditions.

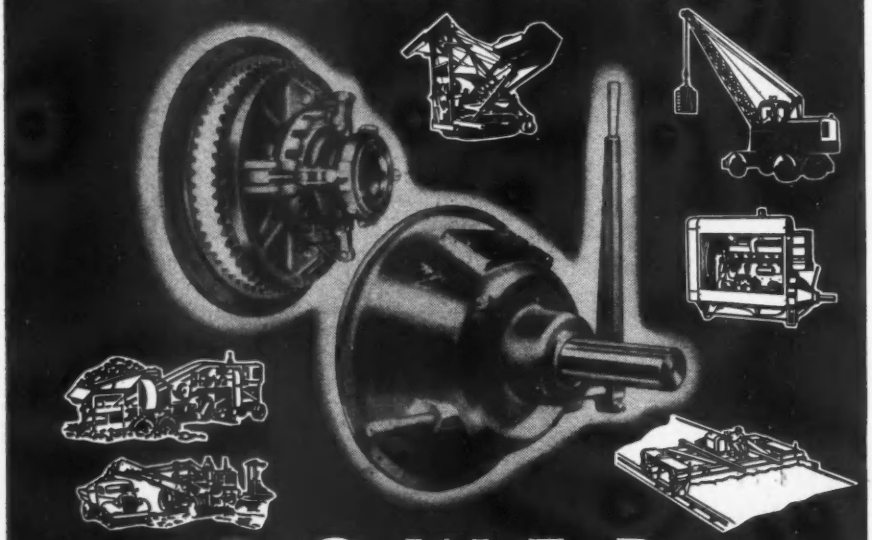


Bede hot-spray painting process

Main function of the process is to heat paint to any desired temperature (generally approximately 200 F) through use of the Bede paint heater. Two separate models are offered; one that heats paint only, and one heating both paint and air. They are used as auxiliary aids to accomplish complete temperature control in spraying operations. Atomizing air and product surface can also be heated to obtain the ideal temperature combination.

The new system is said to reduce paint viscosity and lower the amount

ROCKFORD



POWER TAKE-OFFS

SELF CONTAINED UNIT
WIDE RANGE OF SIZES
CONSERVATIVE RATING
ROLLER BEARINGS
FINE ADJUSTMENT
ACCURATE BALANCE
S.A.E. DIMENSIONS

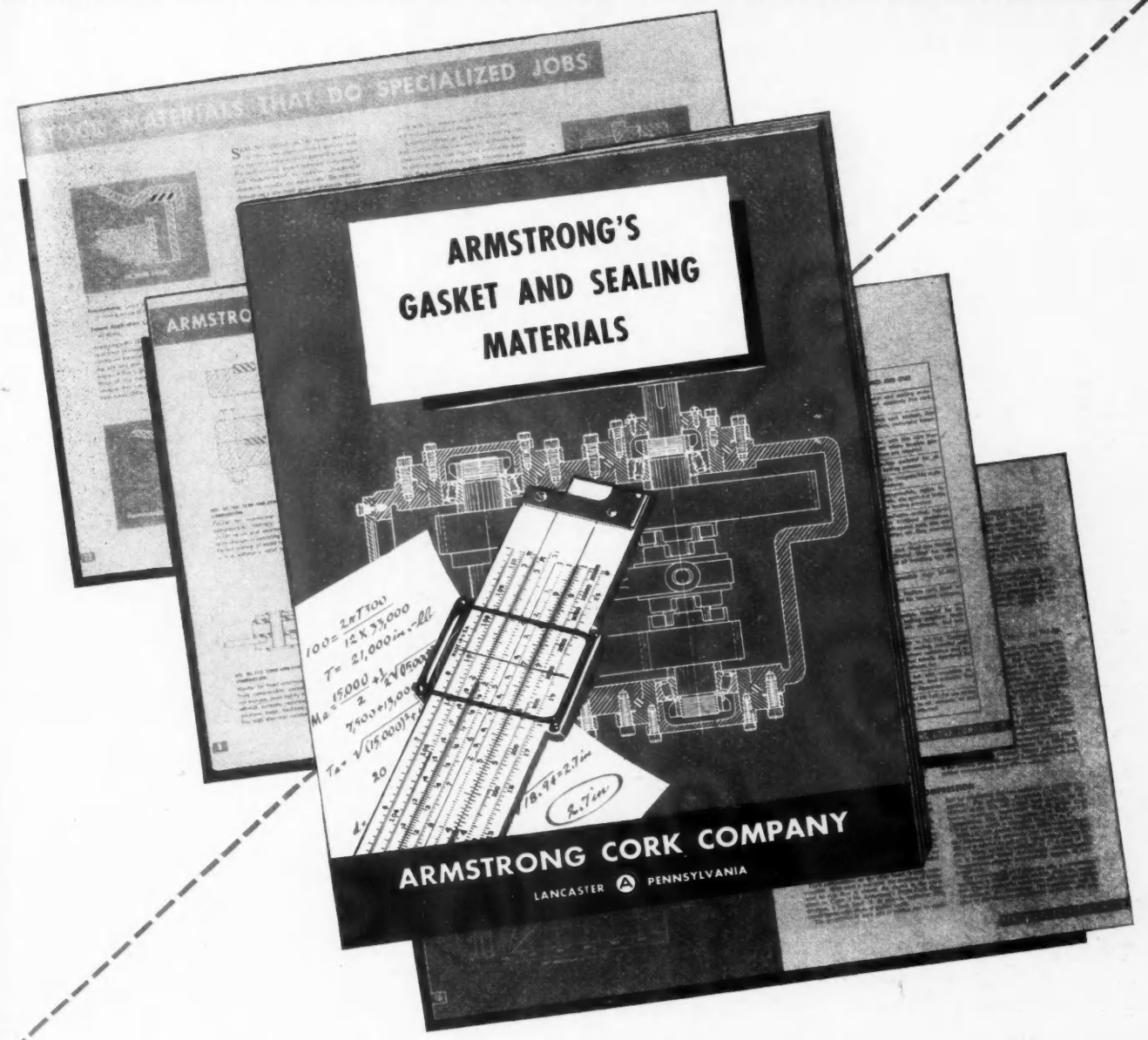
*ROCKFORD POWER TAKE-OFFS are equipped with roller bearings of ample proportions for carrying the loads to be placed upon the unit. The proportions of the bearings and shaft are determined by the load capacity of the clutch selected. ROCKFORD POWER TAKE-OFFS are designed for generous overload capacity.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
315 Catherine Street, Rockford, Illinois, U.S.A.

SEND FOR THIS GASKET HANDBOOK



Here's the new, enlarged, 24-page edition of "Armstrong's Gasket and Sealing Materials." Contains all the helpful technical data that made the first edition so popular with design engineers and purchasing agents. Also suggests methods of putting Armstrong's stock materials to specialized uses in such fields as the radio, electrical, automotive, petroleum, and transportation industries. Includes latest government specifications—plus up-to-date charts on synthetic rubber, cork-and-synthetic rubber, cork composition, and fiber sheet sealing materials. For your copy of this new booklet, fill in coupon below and mail today.

NEW EDITION CONTAINS

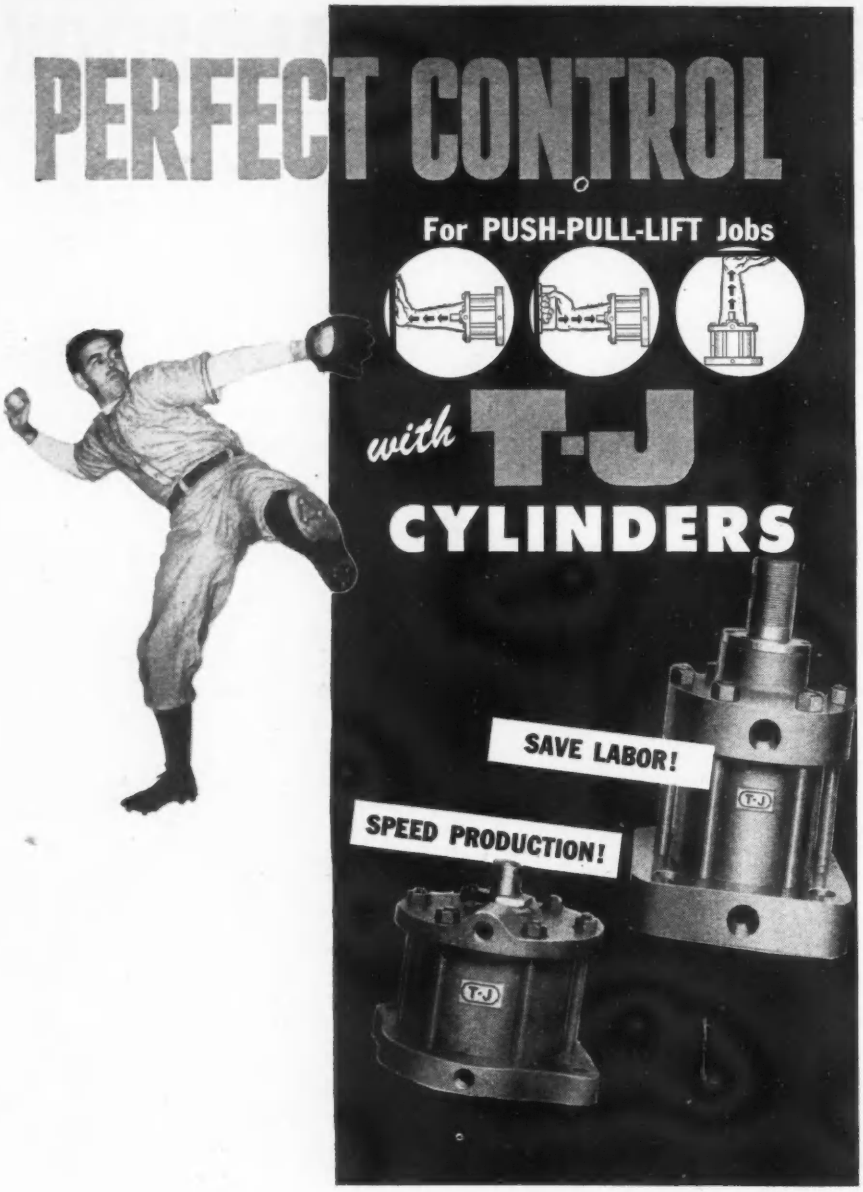
- **Ten technical discussions**
- **Useful charts**
- **Data on gasket materials**
- **Typical applications**

ARMSTRONG CORK CO.,
Gaskets and Packings Dept.,
1509 Arch Street, Lancaster, Pa.

Please send me at once a copy of the new 24-page booklet, "Armstrong's Gasket and Sealing Materials."

NAME.....
COMPANY.....
ADDRESS.....
CITY.....STATE.....

ARMSTRONG'S
GASKETS • PACKINGS • SEALS



More than a "muscle saver"—T-J Air and Hydraulic Cylinders give you *accurate automatic control* for operations of all kinds where pushing, pulling or lifting is needed. Depend on T-J Cylinders to simplify machines . . . save time and labor . . . and do the job *right* at all times. Available in many standard sizes and styles . . . 100 lb. or 50,000 lb. . . . both cushioned and non-cushioned types. Precision-built with rugged dependability . . . backed by 31 years of know how. Write today for catalogs. The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY T-J

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

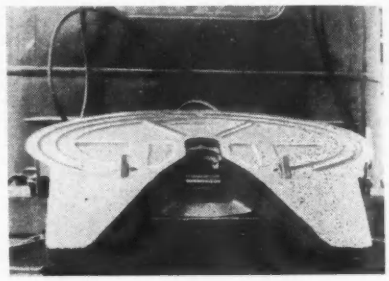
NEW PRODUCTS

(*Continued from page* 62)

of thinner required. This permits cutting down on the air pressure and keeping over-spray at a minimum. Advantages include fewer sags, greater film thickness, faster drying, faster gum action, smoother finish and more gloss, according to Bede.

P-60—Safety-Support Fifth Wheel

Vast improvement for open-road trucking is afforded by the new design in the Apgar safety fifth wheel, manufactured by the Bound Brook Safety Equipment Co., Bound Brook, N. J. Designed to support the trailer front end uniformly at all times, it features a rotary disc made an integral part of a conventional fifth wheel assembly, plus



Apgar safety fifth wheel

a king pin offset which tends to safely counteract centrifugal force on turns.

The rotary disc provides a new and wider support for the front of the trailer, and the king pin offset shifts the trailer front end centerweight four inches to the inside, rounding curves. This compensates for the normal tendency of the load to shift to the outside; curbs swaying, rolling, and complete overturning, as well as jack knifing and trailer bed warping.

The Apgar fifth wheel consists of a rotary disc or plate welded to the regular trunnion rod brackets of a conventional fifth wheel assembly, and machined to turn on the base plate below it. Turning surfaces therefore are between the rotary disc and the base plate, the normal fifth wheel bearing surface becoming inoperative. Because the trunnion shaft is solid mounted on the rotary disc instead of on the tractor, the trunnion shaft remains parallel to the trailer axle at all times. The result is a solid support for the trailer front end at any turning angle.

The offset construction consists in the trunnion rod being located four inches behind the kingpin on the rotary disc. During a turn this construction causes the center point of the load to shift to the inside, said to provide a stability not available with conventional fifth wheel assemblies.

(*Turn to page* 67, *please*)

NEW PRODUCTS

(*Continued from page* 64)

P-61—Contact-Free Micrometer

Adaptable for production testing of wrist pins, crankshafts, and almost any dimensions having to be held to close tolerances, the Visi-Limit micrometer on display at the September Instrument Society of America Exhibit in Philadelpha, and manufactured by Raymond M. Wilmotte, Inc., makes measurements instantaneously and continuously without the need of accurate positioning of the objects and in spite of vibrations.

Because there is no physical contact with the object, the micrometer is especially applicable to measurements where deformation caused by contact would be a problem.

The operator of the production machine on which the micrometer is installed has before him a continuous visual representation of the dimensional quality of the product, and sees at the same time the permissible tolerance limits. The Visi-Limit system has many variations and possibilities such as colorimetry, turbidimeters, etc. The system basically embodies an AC voltage signal emitted by a photocell.

P-62—Pressure Tubing

New product manufactured by the Precision Tube Co., Phila., Pa., and spotlighted at the Instrument Conference in Philadelphia this week, is the company's pressure tubing for Bourdon gages. This type gage, used to indicate oil pressure, temperature, and air pressure and vacuum where necessary in automobiles, tractors and aircraft, requires pressure-sensitive tubing of exacting metallurgical qualifications. The nth degree of laboratory control in heat treating and testing to meet all Bourdon page specifications is claimed for the new tubing.

P-63—Dangerous Gas Detectors

On display at the National Instrument Conference, Philadelphia, September 13-17, are four new or improved instruments presented by the Mine Safety Appliances Co., Pittsburgh, Pa. They are a new colorimetric carbon monoxide tester, a nitrogen dioxide detector, a carbon monoxide and fire detector for aircraft use, and a combustible gas alarm assembly.

The carbon monoxide tester contains a replaceable indicator tube filled with a yellow silica gel. A sample of air containing carbon monoxide, aspirated through the tube, turns the yellow silica gel a shade of green to be compared with a revolving color scale directly beside the tube which indicates the CO concentration.

The nitrogen dioxide detector consists of a field kit. Laboratory-prepared solutions of the reagents sulfanilic acid and alphanaphthylamine, combined in syringes, are exposed to contaminated air and their change in color is then compared with color plaques which indicate nitrogen dioxide concentration.

The carbon monoxide and fire detector is said to be the only aircraft fire detector approved by the Civil Aeronautics Administration under the CAA Technical Standard Order TSO-C1. Detecting and locating fires through detection of carbon monoxide in the air eliminates false alarms caused by voltage variations, dust, and atmospheric conditions, as the gas can be produced only by combustion.

The combustible gas alarm assembly draws samples of the atmosphere from potentially dangerous locations, continuously tests them at a central panel board, and gives the alarm when the amount of combustibles present at any point approaches the lower explosive limit.

(*Turn to page* 68, *please*)

For
Prompt Radiator Delivery
Look to
Yates-American

Enlarged plant facilities . . . our own foundry . . . labor and materials supply — these permit us to offer unexcelled delivery service on radiators.

We invite your inquiry on heat transfer units engineered especially for your requirements. Applications include motor trucks, tractors, combines, industrial trucks, compressors, locomotives, power plants and other equipment. Also oil coolers, intercoolers, heat exchangers.

A rollcall of Yates-American radiator users includes such names as: Fairbanks-Morse, Buda, Gardner-Denver, Waukesha Motors, Clark Equipment, Continental Motors, General Electric, Oliver, Westinghouse, American Locomotive, Ingersoll-Rand, Allis-Chalmers Mfg. Co. — and many others.

YATES-AMERICAN MACHINE CO.
HEAT TRANSFER PRODUCTS DIVISION
BELOIT, WISCONSIN

SWIFT • SURE • STURDY • SILENT • SMOOTH • STEADY

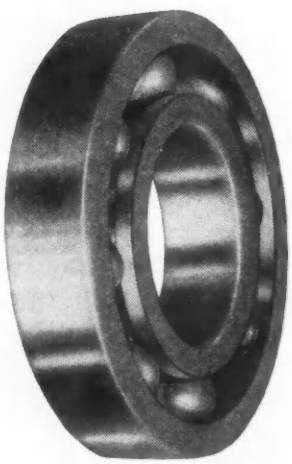
PLAN *Steady* DRAFT-HORSE DEPENDABILITY IN EVERY BASIC DESIGN

You've often remarked that no piece of equipment can be superior to its component parts...

You appreciate the broad recognition and acceptance of BCA Ball Bearings in industry . . .

You know you can tell your engineers to draw upon our half-century of experience in friction control practices, encompassing many varied fields of industry . . .

You, who insist upon continuous, full-capacity, trouble-free operation, know this can be assured by specifying BCA Ball Bearings.



BEARINGS COMPANY OF AMERICA
LANCASTER, PENNSYLVANIA

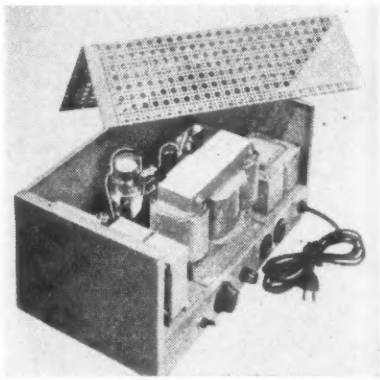
BCA RADIAL-ANGULAR CONTACT-THRUST BALL BEARINGS

NEW PRODUCTS

(*Continued from page* 67)

P-64—Voltage Regulator

Recommended for every type of equipment requiring a constant voltage input, Sorensen regulators, manufactured by Sorensen & Co., Inc., Stamford, Conn., are on view in Philadelphia at the September Instrument Conference, Convention Hall. Sensitive only to voltage changes, the electronic control circuits in these regulators eliminate the inertia of mechanical moving parts to give quick, accurate response to even the smallest voltage changes with no time lag. Wear and time-consuming adjustments are therefore eliminated, and recovery or stabilization time for the correction of transient disturbances in the line are minimized. The voltage regulators are independent of the power factor of the load, functioning equally well under all conditions of varying power fartor. The regulators are said to make it unnecessary to readjust output voltage each time the load is varied as long as the load remains within the rated range of the instrument.



Sorensen model 500 voltage regulator

P-65—Precision Pivots for Aircraft Products

On exhibit at the National Instrument Conference in Philadelphia are Permopivots of Permometal, manufactured by Permo, Inc., Chicago, Ill. For use with precision aircraft products, these pivots are made of the precious metal Osmium, the heaviest and hardest of six rare metals of the platinum group. This and others when melted by secret formulae at 4400 F form a true alloy known as Permometal which resists wear, vibration, corrosion and magnetism as variously required for smooth-performing precision instruments.

Permometal tips are claimed excellent for both sapphire and hardened glass bearings, standard tip radius specifications being listed at 0.001 in. to 0.003 in.±0.00025 in.

FORD-POWERED GERLINGER LIFT TRUCK

The Ford 239 V-8 Industrial Engine is standard on all four models of the Gerlinger Lift Truck—the four, five, six and eight-ton capacities—with four speeds forward and four reverse. Manufactured by Gerlinger Carrier Co., Dallas, Oregon, right in the heart of the lumbering field. These trucks have proven their superiority in flexible, economical materials handling which in a large measure is due to the excellent performance of Ford Industrial Engines. Continuous user of Ford power for over 25 years.

Be Right 3 Ways with FORD Industrial Power!

1. **Right Power!** Not just one, but your choice of five rugged workhorses in the new Ford Industrial Engine line. There's one tailor-made to fit your power needs.
2. **Right Features!** When you specify Ford Industrial Engines you can be sure your power source is right up to the minute, with all the latest features of Ford's progressive, "out front" engineering.
3. **Right Service!** Ford Dealers are everywhere, with the facilities and experience for keeping Ford Industrial Engines right on the job—for longer life, greater service, lower costs.

Ford For *more* power, *better* power—it's Ford. And now the famous Ford "Power-Family" boasts five rugged engines—a "four" of 120 cu. in. displacement . . . two "sixes"—226 cu. in. and 254 cu. in. displacement . . . two V-8's—239 cu. in. and 337 cu. in. Every one new all through—the power that's right for you! Full specifications on request by return mail. Send postcard today!

FORD MOTOR COMPANY
INDUSTRIAL AND MARINE ENGINE SALES DEPARTMENT
3510 Schaefer Road • Dearborn, Michigan

YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED

Jet Propulsion at Low Speeds

(*Continued from page* 48)

fuel consumption, and let it go at that.

A second source of confusion lies in the idea that jet engines are more efficient at high airplane speeds because a jet engine, when installed in an airplane with low drag characteristics (i.e., a high speed airplane) shows a much better fuel consumption per mile travelled, or per hour of flight. A closer look, however, makes it obvious that installing the jet engine in a fast airplane has not improved the thermal efficiency of the engine, but rather the inefficiency of the engine has been offset by the use of an extremely efficient airplane. The fact that the same procedure does not always apply with a reciprocating-engine-propeller power plant does not alter the case, but is simply another proof of the limitation of the propeller as a means of propulsion. That is to say, poor efficiency of the propeller at high speeds may prevent realization of the benefit of the low drag airplane.

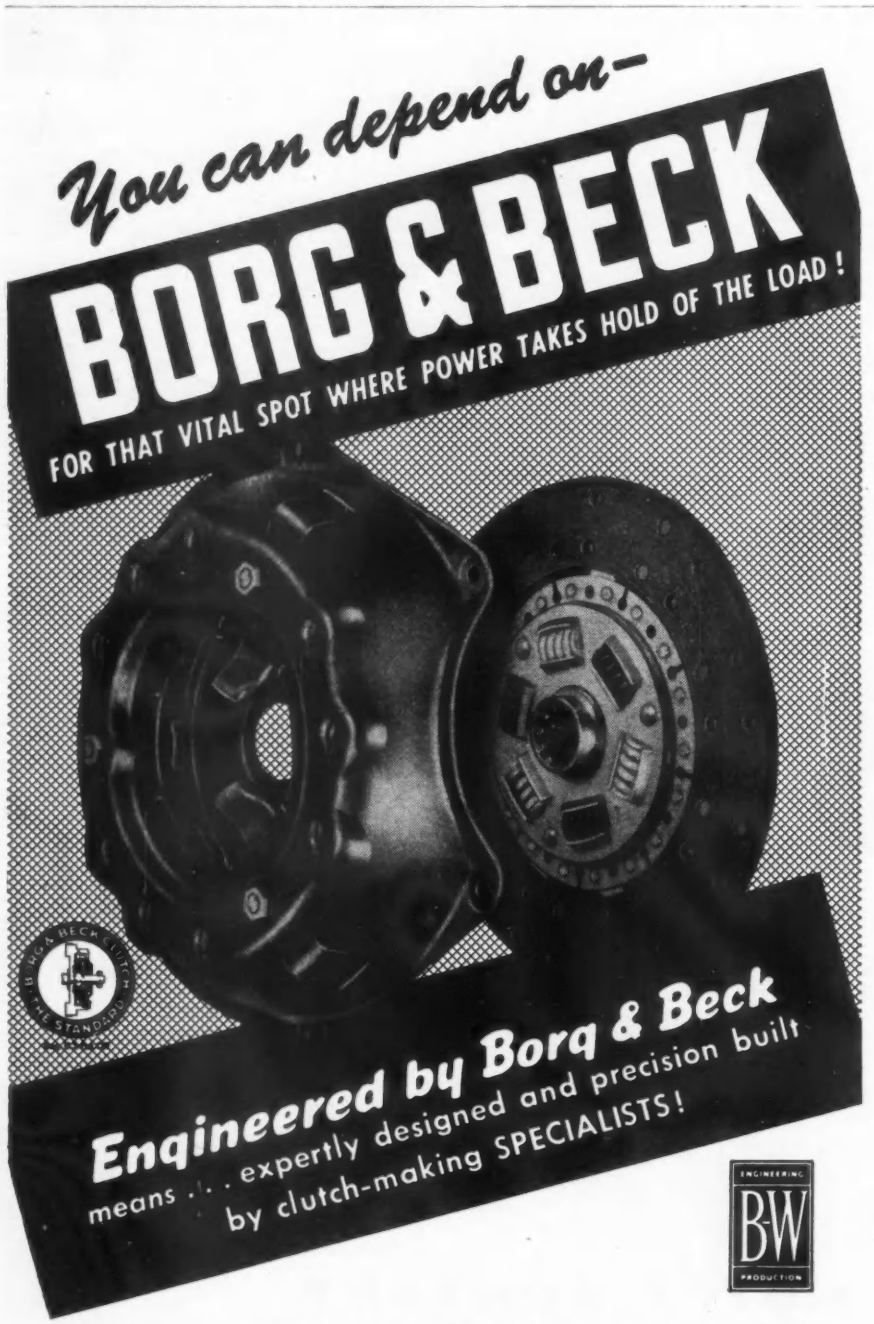
A third and more logical reason for the "propulsive efficiency" concept is the fact, brought out in Fig. 3, that considerably more of the heat energy in each pound of fuel used must be turned into useful work in order to produce the more efficient higher jet velocities. To be specific, the thermal efficiency must be improved four times in order to cut the fuel consumption in half with the same thrust. Obviously, because of this "squared" relation between the velocity from a nozzle and the heat energy required to produce it (viz. $h=[C/224]^2$), a limit in improved thermal efficiency will be approached with increasing rapidity as the fuel consumption is reduced, this limit being the ideal cycle efficiency. This might be a fundamental barrier to the efficient use of jet power plants in slow speed airplanes, depending on how much jet engine fuel consumption must be reduced to match the reciprocating-engine-propeller combination.

Returning to Table I and Fig. 2, it will be seen that for the turbo-jet to exceed the performance of all other types at speeds of 100 mph and up, the fuel consumption would have to be dropped from 1.0 lb per lb thrust per hr to about 0.40, a reduction of 60 per cent. This requirement is without the need of any increase in thrust per pound of weight, since the specific weight of the turbo-jet, in terms of pounds per pound of thrust, is already the best of all types at 100 mph and above. Improvements in fuel consumption are usually accompanied by increased output, and improvements in specific weight are effective for increasing range, as well as reductions in fuel consumption. The final criterion is installed engine weight plus fuel per pound of thrust, and, of course, to determine this figure, the desired range in hours must be known (or in miles if the airplane speed is also known).

These improvements in fuel consumption and specific weight of installed power plant plus fuel are cruising requirements, and it is important to note that, for static or takeoff purposes, the measure of fuel consumption improvement required for equality between the jet and compound engine-propeller power plants is much less. In other words, for takeoff, it is not necessary to obtain both increased thrust and decreased fuel consumption, a fact which has been advantageously taken into account in reciprocating engine practice.

If it is agreed that cruising speeds below 100 mph are of little interest, and that the range from this speed down to static is part of the short time takeoff regime, then it is possible to eliminate the region within which the thrust specific fuel consumption of the compound engine with propeller is so low that the jet engine

(*Turn to page* 74, *please*)



The new NORTON CAM-O-MATIC* Cam Grinder

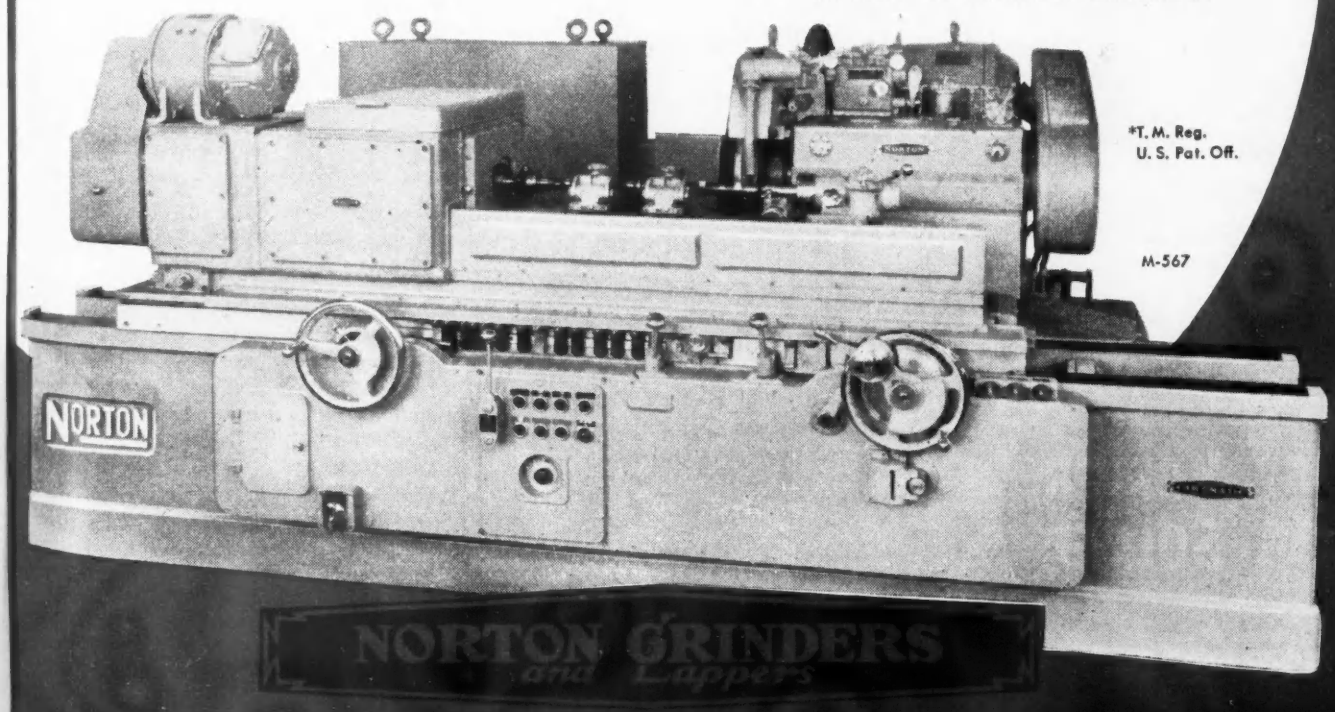
A MACHINE THAT YOU'LL *LIKE* ON YOUR PRODUCTION LINE

YES, you'll really be enthusiastic about the new Norton Cam-O-Matic*—you'll like the finish that it produces on your cams—you'll like the way that its fast, easy automatic operation cuts production costs.

The operator merely loads, starts the grinding cycle by movement of a conveniently positioned lever, then unloads after termination of the automatic cycle. Indexing of the work table and master cam roller and truing of the grinding wheel are all *automatic*. This simplicity of operating effort permits a man to tend two, or even more, machines.

And there's the new ingenious, automatic, continuous variation of work speed as each cam is ground—fast at first for rapid stock removal then slower and slower for a fine finish.

Norton 5" x 30" No. 2 Cam-O-Matic Grinder



*T. M. Reg.
U. S. Pat. Off.

M-567

Standardize on KESTER Cored Solders!

POSITIVE FLUX CONTROL

STANDARD
FOR INDUSTRY
SINCE 1899

UNIFORM FLUX CONTENT

Be absolutely sure of the correct amount of flux and get perfect soldering results every time. Use Kester Cored Solders with their scientific, pure, and uniform flux core.

A COMPLETE TECHNICAL SERVICE

If you aren't getting peak efficiency or have a specific problem in your soldering operations, take advantage of the facilities of Kester's Technical Department. No obligation.

KESTER SOLDER

KESTER
SOLDER COMPANY

4202 Wrightwood Ave., Chicago 39, Illinois

Factories Also At Newark, New Jersey • Brantford, Canada

to match this performance would have to attain thermal efficiencies impractically close to the ideal cycle efficiencies. Then, it could be concluded that the jet-powered airplane can equal or exceed the performance of the best propeller drive engines at all speeds above the top speed of the present automobile.

If, instead of reducing turbo-jet fuel consumption 60 per cent at 100 mph as mentioned above, this consumption could be reduced 35 per cent and the thrust per pound of installed weight-plus-fuel increased 50 per cent, the data of Table I and Fig. 2 indicate that it would be possible to achieve better payload performance at 100 mph cruising than can be obtained with the best engine-propeller combination for ranges reasonable with low-speed aircraft. These figures are necessarily approximate because they depend on what numbers are used for installed engine weight, propeller weight and efficiency, and the other characteristics which vary somewhat according to the particular designs used. It is believed they are representative, and probably conservative in view of the fact that no attempt has been made to take advantage of the better aerodynamic configuration possible with the jet engine, nor the structural weight saving usually permitted by the lighter engine and elimination of the propeller.

To illustrate the size of the development job involved, it will be found that a 35 per cent reduction in specific fuel consumption can be obtained by increasing thermal efficiency from the present figure of about 20 per cent to 35 per cent, and that, to accomplish this, the other requirement of 50 per cent increase in thrust must be obtained by increasing jet velocity 14 per cent and air weight flow 32 per cent.

It is of interest to the automotive industry that these improvements, within the relatively early development range for turbo-jets, can also be applied to shaft-drive gas turbines. The methods of achieving these improvements are, of course, of prime interest. There are at least seven different possible approaches, including afterburning for maximum power accompanied by better thermal efficiency for cruising, and higher pressure ratios.

If current efforts toward improving the thermal efficiency of the gas turbine cycle are successful, the aircraft jet engine eventually will outperform the propeller drive engine in all categories. This means that the jet can be expected to replace the propeller even on relatively slow-speed aircraft, such as the private-owner type airplane.

THE MODERN ELECTRIC RESISTANCE WELDED STEEL TUBING

FOR EVERYDAY USE *Michigan*

WELDED STEEL TUBING

ROUND

1/4" to 4" O.D. 9 to 22 gauge

SQUARE - RECTANGULAR

1/2" to 2" 20 gauge, 1" to 2 3/4" 14, 16, 18 gauge

Throughout the world industrial progress has become synonymous with the production achievements of the Men of Vision in America. And one of the greatest aids to product manufacture has been the use of modern electric resistance welded steel tubing. A constantly increasing number of manufacturers, producing component parts and finished products, is proof of the accuracy and utility of Michigan welded steel tubing. It is available in round, square and rectangular shapes, a wide variety of sizes, to give uniform strength, weight, ductility, ID and OD, machinability and weldability. Can be formed or machined in your plant or come prefabricated by Michigan.

Engineering advice and technical help in the selection of tubing best suited to your needs. Address your inquiries to:

Michigan STEEL TUBE *PRODUCTS CO.*

More Than 30 Years in the Business

9450 BUFFALO STREET • DETROIT 12, MICHIGAN

FACTORIES: DETROIT, MICHIGAN • SHELBY, OHIO

DISTRIBUTORS: Steel Sales Corp., Detroit, Chicago, St. Louis, Milwaukee, Indianapolis and Minneapolis—Miller Steel Co., Inc., Hillside, N. J.—C. L. Hyland, Dayton, Ohio—Dirks & Company, Portland, Oregon—James J. Shannon, Milton, Mass.—Service Steel Co., Los Angeles, Calif.—American Tubular & Steel Products Co., Pittsburgh, Pa.—Strong, Carlisle & Hammond Co., Cleveland, Ohio—Drummond, McCall & Co., Ltd., Toronto, Canada.

New Kaiser Models

(*Continued from page* 31)

A change in the rear engine support cross-member is said to provide greater rigidity and effect an additional road clearance of 1½ in.

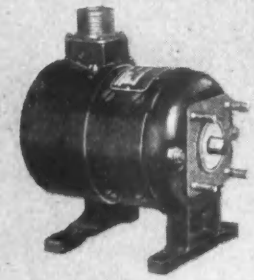
The new clutch linkage eliminates the clutch relay shaft and overcenter spring assembly, and has permitted the moving of the brake master cylinder to the rear of the number two frame cross-member. This results in a reduction in the number of parts from 68 to 16; and a reduction in weight from 7.81 lb. to 3.94 lb. Clutch linkage adjustment, formerly a time consuming operation, has been simplified by cutting down the three rather complicated adjustments on the 1948 model to one simple link adjustment on the 1949 model. Clutch pedal pressure has been lowered from 32 pounds to 25 pounds.

The standard clutch linkage assembly now consists of a one-piece clutch pedal, clutch pedal shaft assembly, clutch cross shaft and lever assembly, adjusting link, clutch pedal return spring, a universal joint coupling and rubber bushings.

In the Kaiser DeLuxe model the new 112 hp engine has been accompanied by a change in the axle gear ratio to 3.91 to 1.

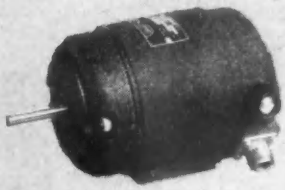
The hand brake and its linkage in both Kaiser cars are new and the brake lever has been relocated in a more convenient position. Greater driver convenience has also been provided by a different spacing of the foot brake and clutch pedals.

Other improvements include an improved hood lock mechanism and new front and rear gravel shields.



Intermittent high torque motor with low weight factor is adaptable to many general applications.

WHY *Lamb Electric* MOTORS are Powering America's *Finest* Products



This small sturdy motor can be readily adapted to a wide range of industrial applications.

- Good Performance
- Dependability
- Light Weight
- Compactness
- Appearance Appeal
- Value Appeal
- Low Maintenance

Universal motor used for commercial vacuum cleaners, wheel balancers, air compressors; etc.

These important qualities contribute to the popular acceptance and satisfactory performance of any product requiring a special application motor.

THE LAMB ELECTRIC COMPANY
KENT, OHIO

Lamb Electric
SPECIAL APPLICATION FRACTIONAL HORSEPOWER MOTORS

Publications Available

(*Continued from page* 58)

in the construction and material handling industries. Numerous photographs and job histories of Cummins-powered equipment are given.

L-83—Second Operation Machines

Hardinge Brothers, Inc.—DSM 59 lists all the features and specifications of the Hardinge High Speed Precision Second Operation Machine and gives information on tooling dimensions and floor plan, headstock spindle tooling, double cross slide tooling, end-working slide and accessories.

L-84—Blast Cleaning

Pangborn Corp.—A new bulletin which describes and illustrates the Rotoblast cleaning method is available. Special blast cleaning machines are illustrated, dust control equipment and accessories are pictured and described.

L-85—Arc Welding Electrodes

Wilson Welder & Metals Co., Inc.—A new, 40-page catalog contains photographs and diagrams, an electrode selector chart and complete details on all electrodes in the Wilson line. Typical data supplied are general description, application, welding procedure, mechanical properties and specifications.

L-86—Electric Motors

Lima Electric Motor Co.—Bulletin MB-1 describes and illustrates the Lima line of electric motors, multi-speed gearshift drives, pedestal grinders and polishing and buffing lathes.

L-87—Seam Welders

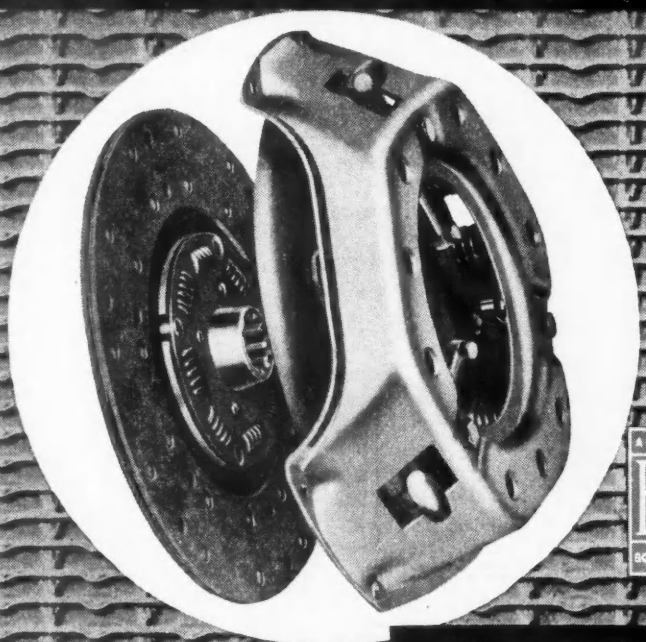
Progressive Welder Co.—An 8-page technical bulletin describes roller head seam welders. The line comprises three basic sizes for light, medium and heavy duty work, each size being available in three types. Important points of design and operations of the welders are described, closeup photographs and labeled drawings are included.

Design . . .

Long clutch and radiator designs meet the specific requirements of individual applications. Our wide range of sizes and capacities serves practically every passenger car, truck, bus and tractor need—high-speed or heavy-duty. *Automotive engineers know this.* Since the earliest days of the automotive industry, they have specified Long clutches and radiators as original equipment for millions of units.

RADIATORS SINCE 1903

CLUTCHES SINCE 1922



A PRODUCT OF B-W BORG-WARNER

LONG

CLUTCHES • RADIATORS • OIL COOLERS

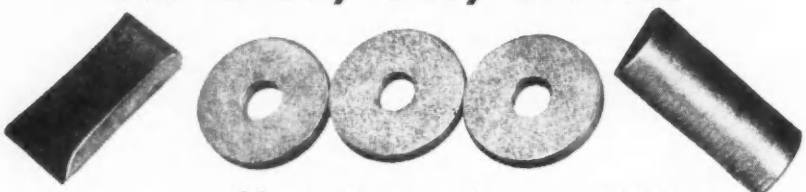
Long Manufacturing Division, Borg-Warner Corporation, Detroit 12, and Windsor, Ontario

It takes Fansteel Metallurgy to produce

Fastell®

ELECTRICAL CONTACTS

for Heavy Duty Service

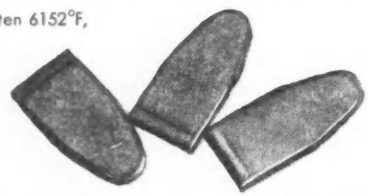


Fastell® (trade name of a group of highly specialized powder metallurgy compositions, made exclusively by Fansteel) combines the high melting point, low arcing and non-welding properties of high refractory metals such as tungsten* or molybdenum* with the high conductivity and low surface resistance of silver or copper. These metals are not alloyed, not merely bonded, but *integrated* by Fansteel techniques in correct proportions for heavy duty electrical contact service.

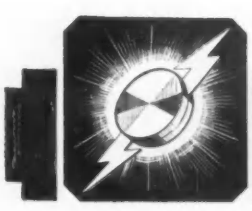
With the correct Fastell contacts, your product is assured against premature failure due to arcing, against overheating or voltage drop due to contact surface resistance. Fansteel engineers are at your service.

Fansteel Metallurgical Corporation, North Chicago, Ill.

*Melting Points: Tungsten 6152°F, Molybdenum 4757°F.



A complete coverage of Fansteel Electrical Contacts for all services is provided in this manual. Ask for your copy.



Fansteel

ELECTRICAL CONTACTS
and CONTACT ASSEMBLIES

AIRBRIEFS

(*Continued from page* 35)

financially inefficient lines, widely varying "mail" pay to two airlines flying the same routes, etc. Although few see a recurrence of the 1934 "air mail scandal," there appears little doubt that a housecleaning is in store in the next few months.

New Runway Laid

First stretch of prestressed concrete runway has been installed at Orly Field, near Paris, France, by Eugene Freyssinet, who designed and patented the new method. The strip is 1400 ft long, 200 ft wide and 6 in. thick and is claimed capable of supporting loads equal to those of a conventional runway four times as thick. The experimental installation uses 45 deg diagonal joints making only transversal prestressing necessary. Freyssinet claims his runway can support aircraft three times the weight of any yet built.

CALENDAR

Conventions and Meetings

International Foundry Congress, Prague	Sept. 12-19
Instrument Soc. of Amer., Natl. Instrument Conf. & Exhibition, Philadelphia	Sept. 13-17
Industrial Experimentation Training Conf., Columbia University	Sept. 14-18
Natl. Assoc. of Motor Bus Operators, Chicago	Sept. 15-17
Turin (Italy) Auto Show	Sept. 15-26
Natl. Assoc. of Foremen Convention & Silver Anniversary, Phila.	Sept. 23-25
3rd Natl. Plastics Expo., New York City	Sept. 27-Oct. 1
Commercial Motor Transport Show, London	Oct. 1-9
New England Materials Handling Exposition, Boston	Oct. 5-7
SAE Aeronautic & Aircraft Eng. Display, Los Angeles	Oct. 6-9
Paris Auto Show	Oct. 7-17
American Soc. Tool Engineers Convention, Los Angeles	Oct. 11-13
Inst. of Traffic Engineer Annual Mtg., Phila.	Oct. 11-13
Automotive Parts Rebuilders' Assoc., St. Paul	Oct. 16-18
Nat'l. Metal Trades Assoc., New York City	Oct. 18-20
Natl. Safety Council Safety Congress & Expo., Chicago	Oct. 18-22
Automobile Old Timers Annual Mtg., New York City	Oct. 19
SAE Production Mtg., Cleveland	Oct. 21-22
Amer. Welding Soc. Annual Mtg., Phila.	Oct. 25-29
Amer. Soc. for Metals Nat'l. Metal Congress & Expo., Phila.	Oct. 25-29
London Passenger Car Show	Oct. 27-Nov. 6
Society of Motor Mfrs. International Motor Exhibition, London	Oct. 28-Nov. 6
Amer. Soc. Body Engineers, Annual Convention, Detroit	Nov. 3-5
SAE Fuels & Lubricants Mtg., Tulsa	Nov. 4-5
Automotive Service Industries Show, Navy Pier, Chicago	Dec. 6-10
SAE Annual Mtg., Detroit	Jan. 10-14
Nat'l. Materials Handling Expos., Phila.	Jan. 10-14
Natl. Auto Dealers Assoc. Convention & Equip. Exhibit, San Francisco	Jan. 24-27
Automotive Access. Mfrs. Annual Expos., New York City	Feb. 7-11

ALUMINUM PLAYS PART IN REDUCING DEAD WEIGHT FOR:

- **IMPROVED ACCELERATION**
- **GREATER ROAD STABILITY**
- **LOWER FUEL CONSUMPTION**
- **REDUCED VIBRATION**
- **LESS MAINTENANCE COST**

THE things you want most in a motor coach you'll find with Ford. The newest features are real cost-savers. Aluminum is used all over. It's stronger, lighter, more flexible and safer.

Engineered for lower center of gravity, the Ford Motor Company's new coach has aluminum for body panels, structurals, and for satin-finish trim. Many forms of this modern metal can be incorporated in your designs; sheets, extrusions, roll-formed shapes, structurals and a variety of finishes offer more adaptations to progressive manufacturers. Here again, Reynolds *Lifetime* Aluminum serves the transportation world better, longer and with actual economy.

Consider aluminum . . . consult Reynolds. Without obligation, ask your local Reynolds Sales Office or write to Reynolds Metals Company, Aluminum Division, 2513 South Third St., Louisville 1, Ky.

IF YOU SEE RUST YOU KNOW IT'S NOT ALUMINUM

REYNOLDS METALS

REYNOLDS *Lifetime* ALUMINUM

REYNOLDS PIONEERING MADE ALUMINUM COMPETITIVE . . . TAKE ADVANTAGE OF IT!

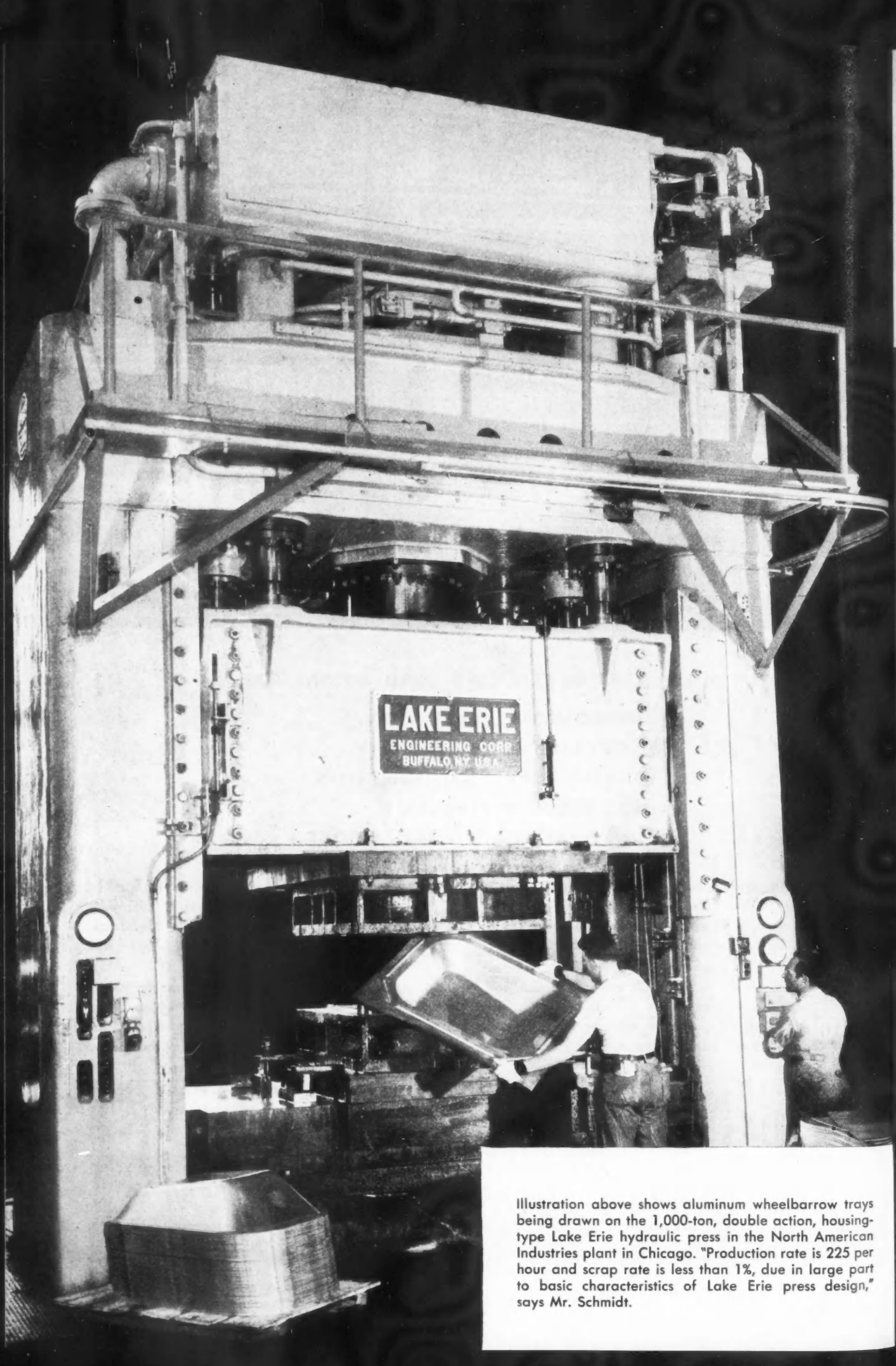


Illustration above shows aluminum wheelbarrow trays being drawn on the 1,000-ton, double action, housing-type Lake Erie hydraulic press in the North American Industries plant in Chicago. "Production rate is 225 per hour and scrap rate is less than 1%, due in large part to basic characteristics of Lake Erie press design," says Mr. Schmidt.

NORTH AMERICAN INDUSTRIES
deep draws 225 large pieces per hour
on LAKE ERIE Hydraulic Press

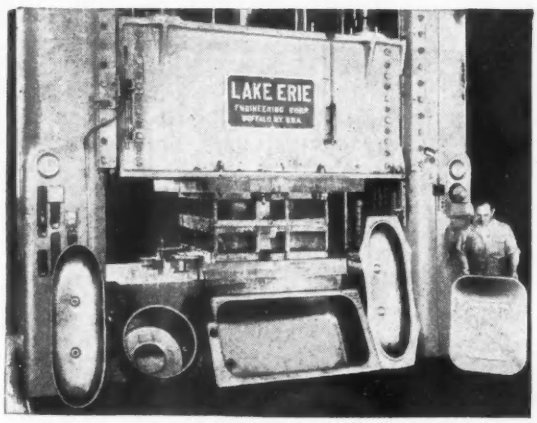
LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

"Rapid approach and return strokes combined with fast drawing speed even at maximum tonnage makes high production rate possible,"
Says **THUR SCHMIDT,** General Manager

The one-piece bath tub stampings shown above are drawn cold in a single operation to a depth of 15" from 14 gage steel. "Consistent success has been achieved with both hot-rolled and cold-rolled mild steel, aluminum and various alloys of stainless with the Lake Erie press," says Mr. Schmidt.

If you are searching for ways to step up production, improve quality or lower your costs...the accomplishments of this 1,000-ton Lake Erie Hydraulic Press are worth contemplating. It does with ease and precision, in a single fast action, jobs that are either impossible or require multiple operations by other methods. Many top-flight manufacturers are already using this Lake Erie design and can tell you plenty about its speed and versatility. Space doesn't permit us to list the users or complete specifications of this design which is available in capacities of 400-tons and up. But we'll be glad to forward any data you desire if you care to look into the matter further.

LAKE ERIE ENGINEERING CORP.
MANUFACTURERS OF
HYDRAULIC PRESSES AND SPECIAL MACHINERY
General Offices and Plant:
509 Woodward Avenue, Buffalo 17, New York
DISTRICT OFFICES IN NEW YORK, CHICAGO AND DETROIT
Representatives in Other Principal Cities in the United States and Foreign Countries



A wide-range of products, some of which are shown at left, are drawn on this versatile Lake Erie press. Runs of as high as 60,000 pieces have gone through the press. "An important feature of the press," says Mr. Schmidt, "is the ease with which adjustments for stroke, tonnage and gage variation may be made when necessary during the course of production runs."

★

The North American Industries wheelbarrow at right is light, strong, attractive and perfectly balanced.

LEADING MANUFACTURER OF HYDRAULIC PRESSES—ALL SIZES AND TYPES—METAL WORKING...PLASTICS MOLDING FORGING...METAL EXTRUSION...PROCESSING...RUBBER VULCANIZING...STEREOTYPING...SPECIAL PURPOSE

Personals

Recent Personnel Changes and Appointments at the Plants of the Automotive and Aviation Manufacturers and Their Suppliers.

New Departure Div., General Motors Corp.—**Lester G. Sigourney**, General Sales Manager, has retired. He will be succeeded by **Frank J. Miller**, who has been in charge of the company's Chicago office. **William T. Murden** has been made Resident Manager of the division's Meriden, Ct., plant.

Oldsmobile Div., General Motors Corp.—**L. F. Carlson** has been appointed General Merchandising Manager. **W. O. Lampe** was named Asst. General Merchandising Manager. **L. L. Johnson** was named Administrative Asst. to the General Sales Manager, the position previously held by Mr. Lampe.

Ford Motor Co.—**Gerhardt Bartz** has been appointed plant superintendent of the Company's Spring and wheel plant at Hamilton, Ohio.

Lincoln-Mercury Div., Ford Motor Co. —**H. D. Solomon** has been named assistant to **Neill S. Brown**, General Manufacturing Manager, and **G. S. Borgquist** has been appointed Lincoln plant manager in charge of production.

General Electric Co.—**Frank T. Lewis** was appointed Manager of Manufacturing in the Aeronautic and Ordnance Systems Div. **Dr. Ward Harrison**, Director of Engineering, has resigned. He will be succeeded by **Willard C. Brown**, his assistant.

Dearborn Motors Corp.—**Wilbur A. Schaich** has been named Patent counsel.

Northrup Aircraft, Inc.—**R. W. Millar** has retired as Chairman of the Board of Directors. He will remain a director, member of the Executive Committee and will be Chairman of the Finance Committee.

The Federal Machine and Welder Co. —**A. R. Kelso** has been appointed Executive Vice-President.

Willys-Overland Motors—**Rear Admiral Robert W. Cary** (retired) has been appointed Asst. to the Executive Vice-President, **Arthur J. Wieland**.

Republic Aviation Corp. — **D. K. Tasker** has rejoined the company and will serve as Asst. to the President, on special assignment.

Titan Metal Manufacturing Co.—**W. W. Sieg** has been elected President.

Tuthill Pump Co.—The appointment of **E. W. Chapman** as Vice-President in charge of Engineering has been announced.

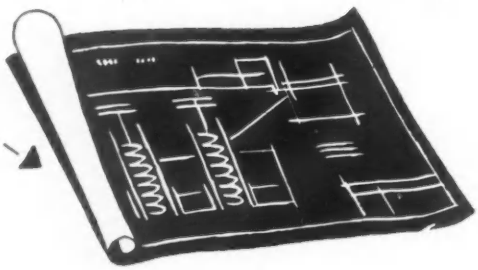
Ansul Chemical Co.—**F. J. Hood** has been elected President of the company —he succeeds **Harvey V. Higley**, who has been named Chairman of the Board of Directors. Other officers elected are: **R. C. Hood**, Vice-President; **H. C. Higley**, Secretary; **J. F. Asell**, Treasurer, and **S. R. Holmquist**, Comptroller and Asst. Treasurer.

Ethyl Corp.—**Dr. Harold A. Beatty** has been appointed to the newly-created position of Asst. Director of Research at the company's Research Laboratories in Detroit.

Skilsaw, Inc.—**J. J. Topolinski** has been elected Vice-President in charge of Manufacturing. **Walter W. Kemphert** has been elected Vice-President in Charge of Sales.

Lion Oil Co.—**Ray David Cunningham** has been appointed Manager of Protective Coatings Dept.

Do the FINAL Springs show in your Blueprints?



Wise design engineers make sure they have the exact springs for the product—when it's still in the blueprint stage. For they have learned that early spring selection pays big dividends in product quality, production economy and in avoiding trouble.

Before you specify the springs or wireforms for your new products, call in a Lewis Spring Engineer to help you select the most practical, economical springs for the job to be done. Lewis engineers have saved manufacturers thousands of dollars by recommending equally effective, but more economical springs than the ones originally specified. They are thoroughly experienced in all phases of spring design, manufacture and applicability to products and welcome the opportunity to help you with spring problems.

Regardless of your production plans — whether your spring requirements are large or small, or they're yet indefinite—Lewis will be glad to work with you. But call in the Lewis Spring Engineer *early*, while he can help you specify and save you money.

LEWIS SPRING & MANUFACTURING COMPANY
2644 WEST NORTH AVENUE CHICAGO 47, ILLINOIS

Lewis PRECISION SPRINGS
THE FINEST LIGHT SPRINGS AND WIREFORMS OF EVERY TYPE AND MATERIAL

READ

AUTOMOTIVE INDUSTRIES

to keep well informed

ONE STEP in the right direction and you're in comfortable, cheerful

HOTEL CLEVELAND.

Convenient to stores, Public Auditorium, Stadium, theatres. Directly connected by covered passage to Union Passenger Terminal, garage, Terminal office buildings.

Write for reservations. Best choice of rooms Thursday through Monday.

Hotel Cleveland

CLEVELAND, OHIO

Quality Control for Truck Transmissions

(*Continued from page* 34)

noteworthy that the case line contains a complete line of Ex-Cell-O machines and a separate lineup of Baker machines designed to handle the same operations. An interesting example of the type of equipment used in this department is the big Ex-Cell-O, trunnion-type machine illustrated here. The fixture holds eight cases at a time; boring, drilling and tapping all holes in both ends. Following this step, the cases go to another Ex-Cell-O machine for final precision boring of the mainshaft and countershaft holes.

The case presented an unusual problem. While the major sequence of operations offered no difficulty, the two ¼-20 tapped holes in bosses in the floor of the case, 12 in. below the cover face, posed a problem. The final solution is found in the installation of the special Rehnberg-Jacobson drilling machine. As shown, this machine has four heads arranged about the table, the latter fitted with a rotary indexing fixture for holding the work. The first two heads drill the holes, the second pair does the tapping. Heads enter the work with rapid traverse to span the 12-in. gap quickly, then slow down for drilling and tapping.

One of the latest developments in the plant is the adoption of induction hardening on a few parts that defy other methods. The Budd electronic heater illustrated here is typical of the equipment installed for this purpose. Its function is to harden the tips of shifter forks as well as a large area on the other end of the fork. Not only does induction heating speed the selective hardening but it also makes possible the production of a shallow hard depth essential for the part.

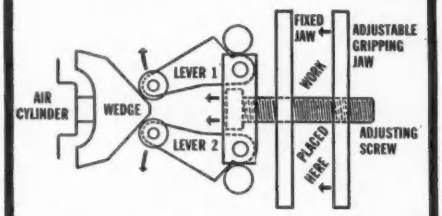
Induction hardening also has been applied for three outer segments of the synchronizer clutch hub. In this case, conventional methods were out of the picture because it is necessary to have selective hardening, leaving the hub core in a soft condition. Moreover, it would be practically impossible to prevent distortion of the work with any other known technique.

Spot peening is used on certain selected gears and shafts subject to unusual stress. As illustrated, the parts are racked on the table of the Pangborn Tablast machine and in this position the gear teeth and other elements of gears or shafts are subjected to shot peening. Over a period of time this procedure has been found to yield excellent results, translated in terms of greatly increased life and freedom from failure in the field.

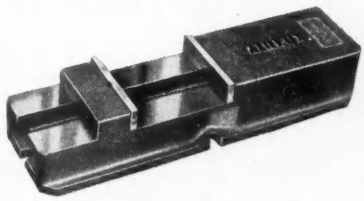
The AIRLOX guts

THE GUTS

This diagram of the patented Senior AIRLOX linkage shows the wedge and lever utilizing total cylinder drive.



The wedge, driven by the air cylinder, forces the levers apart on their fulcrums to pull the gripping jaw toward the work and fixed jaw. Adjusting gripping jaw and stroke permits locating work with assured operator safety.



THE S-13 PNEUMATIC VISE

The AIRLOX Model S-13's quick power stroke speeds production.

For most machine and bench work. Timing of jaw movements with machine used provides automatic operation. B. & S. jaw hole spacing, or your own, allows using your present jigs and fixtures. Enclosed against chips and cutting oils. Carefully ground jaw faces. Special alloy construction. Accurately flanged and keywayed. *Hydraulic drive optional.*

SPECIFICATIONS

Overall: 5¼ x 8⅜ x 29 in. Weight: 130 lb. Stroke: 1/16 to 1/2 in. Jaw-face size: 7 x 1¾ in. Maximum space between jaws: 12 in. Gripping force: air-line pressure times 90. *Increased pressure optional.*

Write for data sheet S-13.

production devices, inc.
Whitehall, New York

AIRLOX: The complete line of pneumatic and hydraulic vises

Profit Paradox

(*Continued from page 25*)

Manufacturing corporations have an obligation to produce a maximum of the articles needed by society. They also have an obligation to their shareholders, to their employes and to the public to operate profitably and to earn funds with which they can expand and function more efficiently. Demagogues have been joined by some well-intentioned but uninformed people in screaming a denunciation of the 1947 corporation earnings of more than $17 billion which is only 5½ per cent of the sales of these companies. Furthermore, this total profit figure is actually less than the amount that the Department of Commerce now estimates is necessary for new plant expenditures in 1948.

With all its faults, the American private ownership system contributed salutary public benefits while providing in 1947 total corporate profits of over $17 billion. It permitted payment to many millions of shareholders of 40 per cent of total earnings, or approximately $7 billion; it made possible increases in weekly earnings of factory workers to a point that is 119 per cent above the 1939 base (while living costs rose approximately 70 per cent) and enabled companies to pay out part of the cost of rehabilitation and expansion necessary to furnish employment and provide needed goods.

A second paradox of the current profit statements exists in the deceptiveness of the profit figures.

First, profit figures cannot be compared fairly with earlier years because the dollars do not have the same value. Secondly, all earnings are not available in cash as much of the total is tied up in inventory, plant and equipment. Third, increased book value of inventory carried at current acquisition costs tends to lead to an overstatement of earnings. Fourth, profits are inflated because of the inadequacy of present-day depreciation allowances. The amount that companies are permitted to charge off is insufficient to provide for modernization.

One of the important and very successful steel companies for example reports that in 1947 it had a net income of approximately $30 million. After distributing $12 million to shareholders it plowed $18 million back into the business. Its inventories, however, required, in 1947, $15 million more than in 1946 merely to operate its current business. It reports further that its coke ovens originally cost $30 thousand apiece but that it cost $100 thousand each to replace them. This vital equipment was fully depreciated at the lower figure but the ovens must be replaced at more than three times the original cost and the difference therefore of $70 thousand each must be provided in new capital.

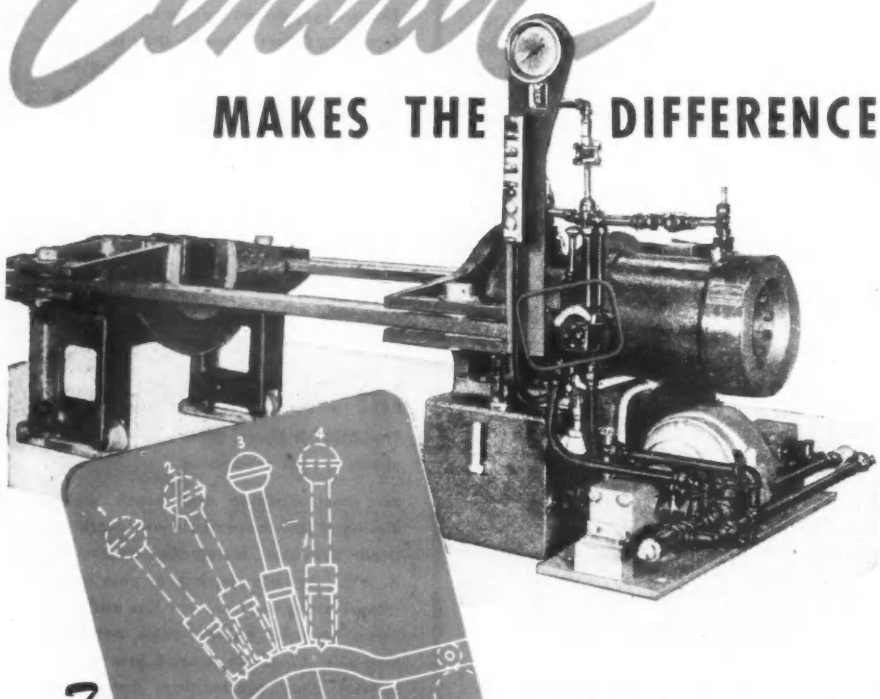
Approximately one-third of the total 1947 corporate profits are "paper profits" for they exist only in the inflation of inventory figures. There is a double danger in this situation; one being that management may delude itself into thinking it has increased its earnings in this amount whereas actually it has only the same relative physical volume of inventory necessary to operate as it had before. The other is that in a period of fluctuating values such inventory ballooning can burst far more quickly than it was blown up.

Record corporation profits composed of inflated dollar figures, inflated inventory accounts, recoveries from treasury carry-back provisions, and which have been set up without taking into account present-day costs of plant modernization constitute a paradox which deserves a more thorough analysis especially on the part of durable goods manufacturers.

A third paradox of the profit situation lies in the failure on the part of

(*Turn to page 88, please*)

Control MAKES THE DIFFERENCE



THIS *all-purpose* R. D. Wood HYDROLECTRIC Horizontal Forcing Press for general machine shop and maintenance service is ideal for assembly and disassembly of heavy machinery components. *Control makes the difference* . . . control of operation by special lever-operated control valve which permits:

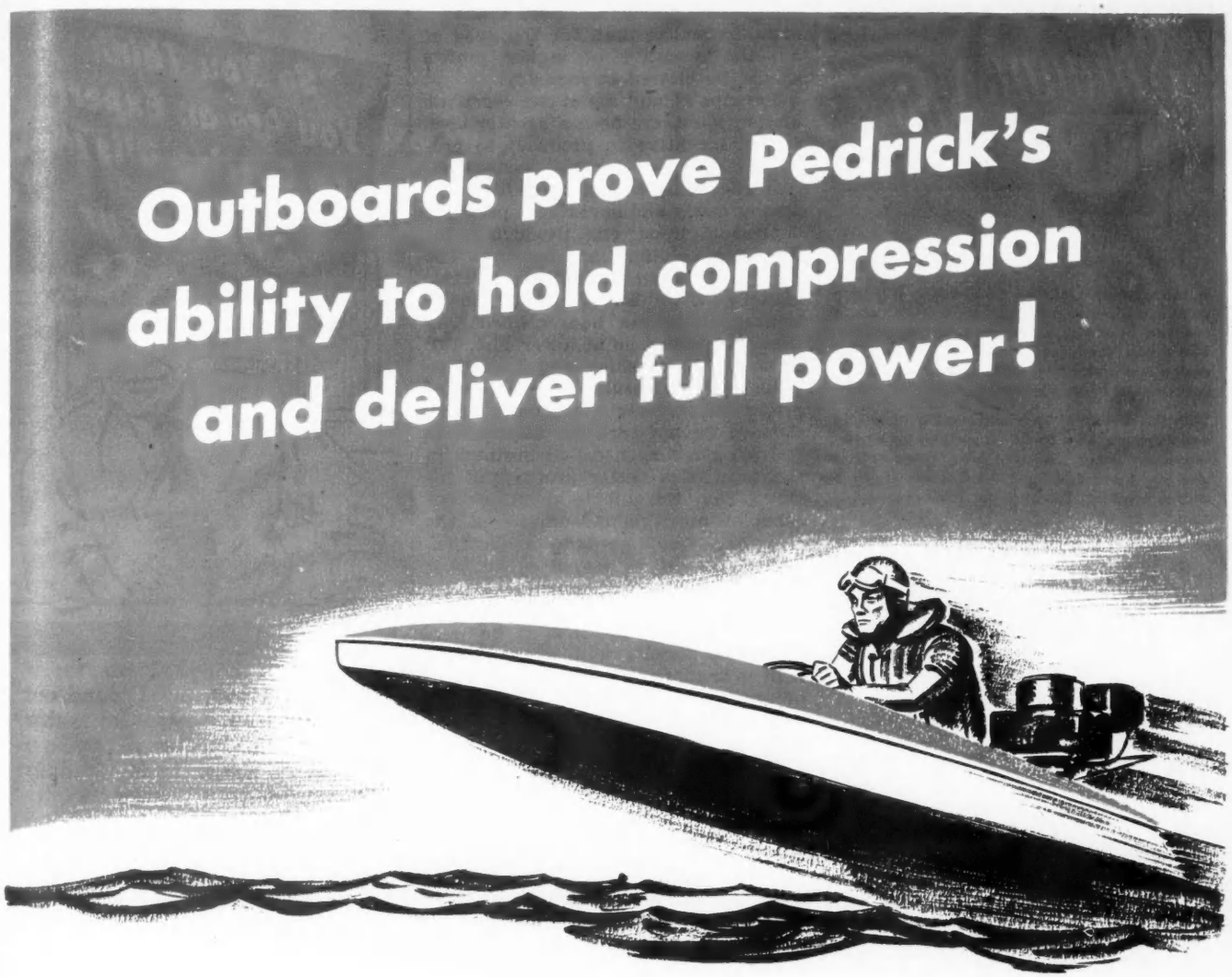
1. *Main cylinder on pressure. Pullback cylinder on pressure. High speed forward—*
   12.7 tons at 400 psi—57" min.
   56 tons at 1,770 psi—12.7" min.
2. *Main cylinder on pressure. Pullback cylinder on exhaust. Slow speed forward—*
   22.6 tons at 400 psi—32" min.
   100 tons at 1,770 psi—7.2" min.
3. *Neutral—pumps by-passing to oil reservoir.*
4. *Main cylinder on exhaust. Pullback cylinder on pressure. High speed return stroke—72.5"/min.*

Other designs, sizes and capacities are available to meet a complete range of manufacturing and maintenance requirements. Send for detailed specifications or engineering advice. R. D. Wood Company, Public Ledger Bldg., Philadelphia 5, Pa.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE • ACCUMULATORS • ALLEVIATORS • INTENSIFIER.

R.D. Wood Company
EST. 1803

Outboards prove Pedrick's ability to hold compression and deliver full power!



"There's something about your rings different from any others," writes an outboard racer. "Your wall tension stays up longer. After a ring is installed and broken in by two or three laps wide open, power holds up longer on Pedricks than on any others."

You couldn't ask for a more demanding compression test than outboard racing. It takes an unfailing seal to build up the high r.p.m. needed to win a race. The ability of Pedrick piston rings to maintain a dependable, longer-lasting seal in any engine is due mainly to the exclusive "Heat-Shaping" process.

"Heat-Shaping" distributes radial pressure uniformly around the circumference of the ring. There's no tendency to warp or distort in service. That's why Pedrick "Heat-Shaped" rings retain peak efficiency longer. That's why they save gas, save oil, and reduce maintenance costs. WILKENING MANUFACTURING CO., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada) Ltd., Toronto.

Pedrick®

"HEAT-SHAPED" PISTON RINGS

FOR 28 YEARS, SUPPLIER OF PISTON RINGS TO LEADING VEHICLE AND ENGINE MANUFACTURERS

Silicone News

DC SILICONES

Silicones are Salesmen

In a competitive market your strongest selling point is a superior product. Constant vigilance is required, however, to maintain that superiority. That's why top management men as well as design and production engineers are taking such keen interest in our silicone products.

With this family of new engineering materials, designers are able to do all sorts of previously impossible things. Skillfully used, Silicones can give you a sound, competitive advantage. Take silicone electrical insulation for example.

PHOTO COURTESY AUTOMATIC TRANSPORTATION COMPANY

Skylift Electric Truck motors are wound with DC Silicone Insulation which has 10 times the life and 10 times the wet insulation resistance of Class "B" insulation. DC 44 Silicone Grease in the bearings has about 8 times the life of petroleum grease.

Here's an example of the way Automatic Transportation Company of Chicago capitalizes on the competitive advantage our silicone materials give them. Recent ad copy carries this headline in bold-face type.

Only Automatic Skylift Trucks Give You "BURN-OUT PROOF" Silicone Insulated Motors

Skylift Means Uninterrupted Material Handling

That's good selling copy and it's backed up by the amazing stability of our silicone products in all of their various forms. You may be able to improve or protect your competitive position by keeping in touch with Silicone developments through the branch office nearest to you.

Data on all of our DC Silicone Products is given in Catalog No. MI-15.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Atlanta • Chicago • Cleveland • Dallas
New York • Los Angeles
In Canada: Fiberglas Canada, Ltd., Toronto
In England: Albright and Wilson, Ltd., London

Dow Corning
FIRST IN SILICONES

the general public, labor and management to realize that, for the good of all, the incentive of higher profits should be offered to industry.

Perhaps at no time in our economic history has there been a greater need for an incentive to produce—to produce more goods, more economically. The maintenance of life itself, among needy and devastated people is dependent upon our producing for them food, clothing and housing. The shortages of needed goods in this country with the resultant inflationary climb can be remedied only through production at lower cost. The incentive to produce and to reduce costs, with a resultant reduction of prices, is threfore paramount. Why then do we not turn our attention to providing an incentive to business in the form of a better profit opportunity? That we quibble about present rates of profit is indeed one of the paradoxes which needs to be clarified.

Business, of course, does not ask for huge government subsidies to support its prices or to carry on its business. It asks only that it be permitted to operate with greater freedom so that it may have the incentive of profit and so that profits may be used, in part, to supply the income of millions of stockholders, and in part for the modernizing and expansion of its facilities.—

From a paper presented before the Machinery & Allied Products Institute.

Auto-Lite Setup

(*Continued from page* 28)

ture has a rail running from the extreme end to the heating station and each rail carries a small car, so-called. This little car is moved forward from the end of the rail and as it passes under a magazine it picks one lamination. Thus at the end of its travel the car has accumulated six laminations stacked in proper order. This stack then goes into the heating station where it is rapidly heated to 2100 F, the copper plating on the laminations serving as the brazing medium.

A small plating department serves this plant, providing facilities for copper and cadmium plating. Unusual feature is the adoption of two manually loaded batch type tank plating units installed by Hanson-Van Winkle-Munning. Heavy duty tanks are used for this operation, the tanks being transported by hoist on an overhead rail. According to the management this simple installation has worked out so well for job shop operation as to compete with the economy of automatic plating machines.

It is of interest to find that Cincinnati Centerless grinders are employed exclusively for grinding shafts and cylindrical cast iron parts. One of the new set-ups is unusually noteworthy because of the character of

(*Turn to page* 90, *please*)

"Well, I thought I was, too, a long time ago, but I found out that there's an awful lot to this cutting fluid business. It takes a combination of understanding and experience backed by adequate laboratory facilities to determine the needs of a modern metal-working plant. That's why I rely on experienced cutting oil people. They have helped me time and again with sound ideas and practical solutions to difficult machining problems. They've proved to me that the correct cutting fluid, correctly applied, means less trouble and fewer headaches. For guidance on this, give me the *real* 'experts' every time."

—Chip

Call D. A. Stuart Oil Co. when you need expert assistance. Since 1865, this company has devoted its entire interest to cutting fluids and industrial lubrication. We pride ourselves on the quality of our products and the engineering ability of our representatives. Take advantage of Stuart's complete on-the-spot service and laboratory facilities to solve your cutting fluid problems. Write for booklet "Cutting Fluids for Better Machining."

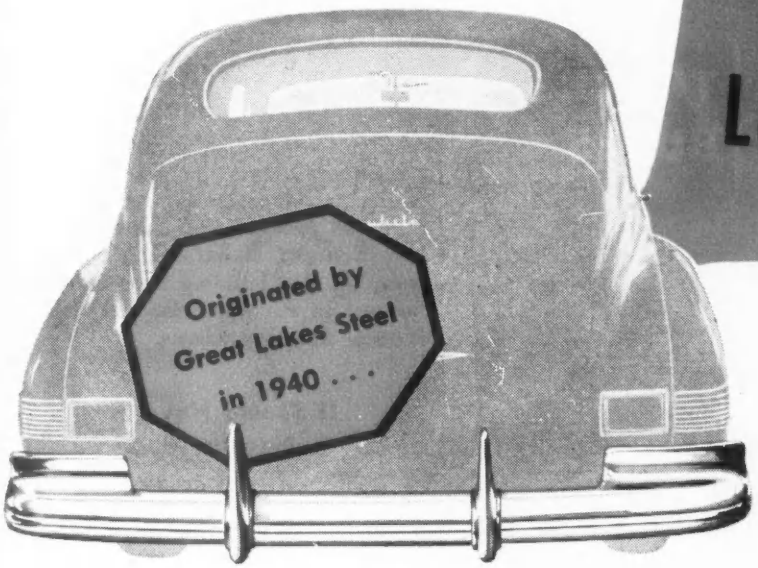
STUART *oil engineering goes with every barrel*

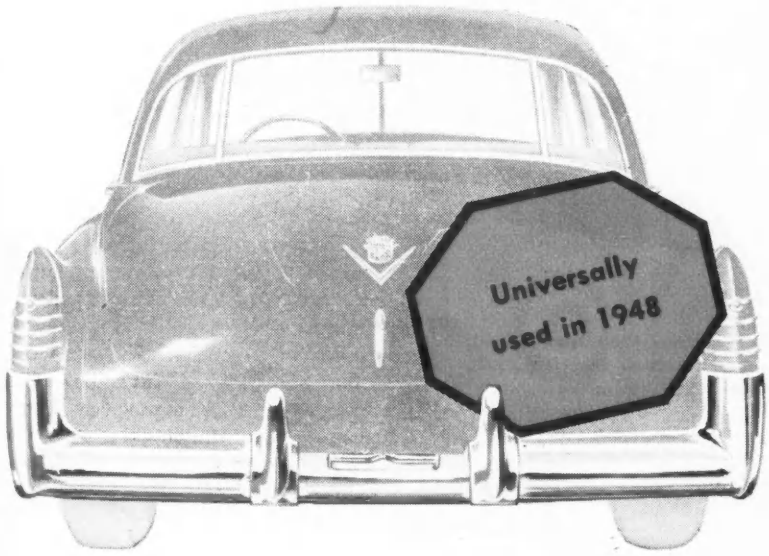
D.A. Stuart Oil CO.
EST. 1865 LIMITED

2733 S. TROY ST. • CHICAGO 23, ILLINOIS

Another First for Great Lakes Steel

Cold-Stamped Bumpers OF High-Tensile Low-Alloy Steel





Over eight years ago the Great Lakes Steel Corporation applied N-A-X HIGH-TENSILE STEEL to the first cold-stamped automobile bumper. This represented the first practical application of high-tensile, low-alloy steel to the passenger car industry.

Today, passenger car manufacturers have universally recognized the superiority of cold-stamped bumpers which utilize the high strength, good formability, and better surface texture of high-tensile steel. Four out of five cars built today have them as original equipment – concrete evidence of the economic value of this Great Lakes Steel contribution to the automotive industry.

MAKE A TON OF SHEET STEEL GO FARTHER
Specify–
N-A-X
HIGH-TENSILE STEEL

GREAT LAKES STEEL CORPORATION
N-A-X Alloy Division • Detroit 18, Michigan
UNIT OF NATIONAL STEEL CORPORATION

the work and tolerances. This job is the finish grinding of distributor shafts in a specially equipped No. 2 Cincinnati Centerless. The work piece is a long, slender shaft having two different diameters plus the inerference of a rectangular plate welded to the shaft part way along its length. The grinder has two separate wheels to handle the two diameters, with a space between the wheels to provide clearance for the plate. The work-holding fixture is of special type to permit loading by the operator, then automatically lowering the work into grinding position.

The set-up does a remarkable job of holding fine tolerances, the total tolerance on the small diameter is 0.00025 in.; on the larger diameter it is 0.0005 in. After grinding, the larger diameter is super-finished, in accordance with the requirements of the customer, in a 12-station Foster Super-finisher.

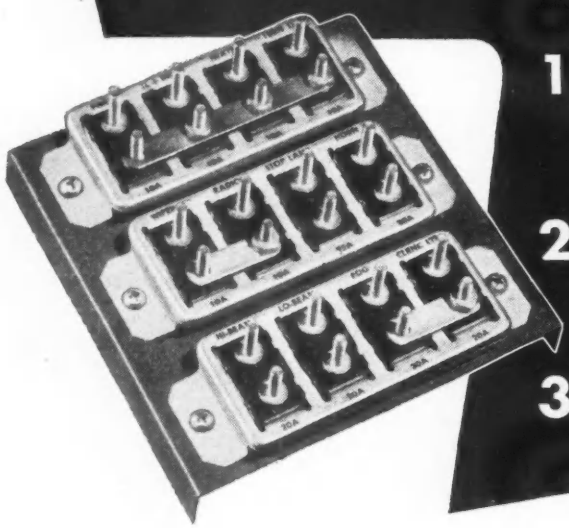
ASM Awards Gold Medal to Francis Frary

Francis Cowles Frary, director of Research, Aluminum Co. of America, has been elected to receive the Gold Medal of the American Society for Metals for 1948.

HERE'S WHY { TRUCKS BUSES

Should be Equipped with

FASCO SNAP-MOUNT Circuit Breakers



1 Finish the run economically and safely . . . despite short circuit.

2 Locate the hard-to-find short safely and quickly.

3 Quick, easy installation.

● With FASCO Snap-Mount Circuit Breakers costly breakdowns due to dangerous overloads and short circuits are eliminated. When trouble develops, the OFF and ON action of a FASCO protected circuit makes it possible to get intermittent use of the circuit without damage to any of the parts.

The cycling OFF and ON action of the circuit breaker allows the mechanic to locate trouble easily and safely . . . and more quickly than would be the case with a "blown" fuse.

The exclusive FASCO Snap-Mount makes installation (for the life of the vehicle) simple and inexpensive. Write for further information or phone our Detroit office, 6432 Cass Avenue, Detroit 2, Michigan. Phone Madison 6300.

FASCO CIRCUIT BREAKERS

©1948

Safeguard Operation of Automotive Electrical Equipment Instantly . . . Automatically . . . from Dangerous Overloads or Short Circuits.

F. A. SMITH MANUFACTURING CO., INC., ROCHESTER 2, N. Y.

Electrical Engineering and Manufacturing Serving the Automotive Field for 26 Years

General News

(*Continued from page 23*)

Award Young for Automotive Achievement

An Achievement Award for "outstanding contribution to the Automotive Industry of Wisconsin," sponsored by the Wisconsin Centennial Automotive Committee, was recently awarded to Fred M. Young, president and general manager, Young Radiator Co., Racine, Wis.

Norton Dedicates New $4.3 Million Plant

The Norton Co., Worcester, Mass., recently dedicated a new $4.3 million manufacturing plant. Over 602 ft long and 320 ft wide and containing about five acres of manufacturing space on one floor, the building is said to be the largest in the world for the manufacture of grinding wheels.

It Should Have Been Handley Page

Handley Page (Reading) Ltd. will produce the Marathon airliner and will be responsible for the repair and service of Miles aircraft instead of the Pioneer Aircraft Co., as incorrectly stated on page 21 of the August 1, 1948, issue of AUTOMOTIVE INDUSTRIES.

Ward LaFrance Organizing Export Corporation

An export corporation, organized to exploit abroad the products of the Ward LaFrance Truck Corp. is in the course of development, under the supervision of A. Ward LaFrance, founder of the Elmira Heights, N. Y., industry which bears his name. The new corporation will be the Ward LaFrance International Inc. The purpose of the new corporation will be to export and sell in foreign countries the products of the local concern, mainly commercial motor trucks, fire apparatus, trackless trolleys and motor coaches, also allied products. Mr. LaFrance has just returned from a trip to France, Holland, Belgium and Switzerland, during which he investigated outlets for the new company and made arrangements for sales and service in those countries. Other countries throughout the world will be opened for the same trade.

(*Turn to page 94, please*)

Do you have a problem in clutch design . . . or in supply of clutch facings or materials?

Call in your R/M representative!

Take advantage of the advice and assistance of the company that's "first in friction materials" . . . for clutch facings as well as for brake linings.

Get the benefit of the pooled experience of four great R/M plants . . . each with its own engineering department, its own pilot plant, its own facilities for laboratory and road-testing.

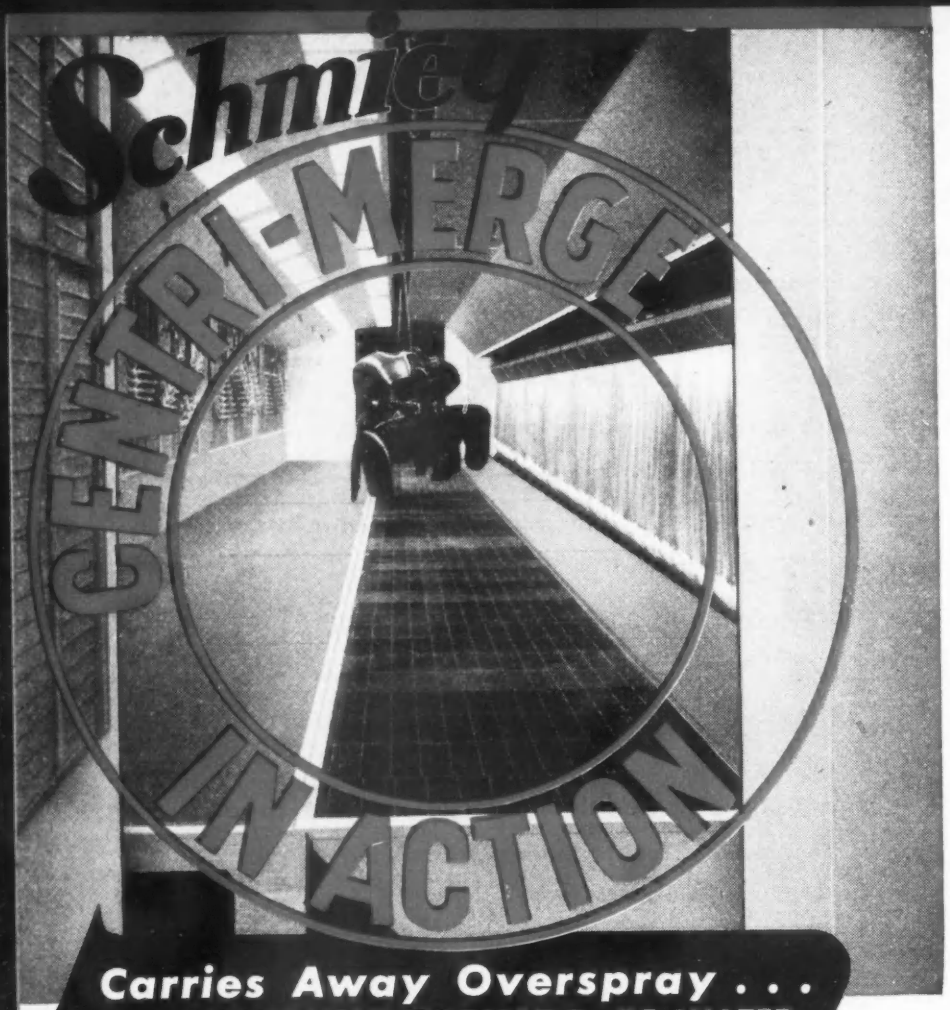
Count on the kind of cooperation that the automotive industry has always received from R/M . . . in developments ranging from the *first* woven clutch facing through the latest improvements in oil-immersed clutches, and in band-type and disc-type automatic clutches.

Remember . . . when it comes to friction materials or automotive rubber products, consult your R/M field engineer, or write direct to headquarters. Please make your inquiry as specific as possible.

we'll face it for you!

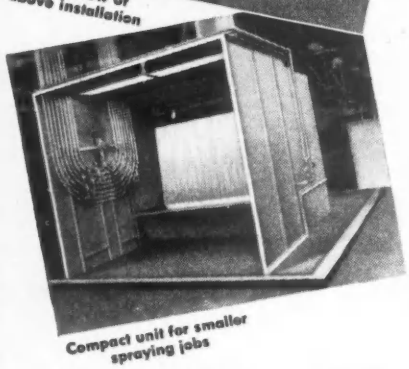
R/M

FIRST IN FRICTION



Carries Away Overspray . . .
IN A WHIRLING TORNADO OF WATER

Exterior view of above installation



Compact unit for smaller spraying jobs

PAINT-LADEN AIR IS "TORNADO" CLEANED. Operators, working in a Schmieg Centri-Merge Spray Booth, are adequately protected from fire and fumes. Overspray is carried on an air stream *horizontally* away from work into a curtain of water, pressure-fed through slots extending continuously full width of booth, that descends down the flood sheet. The mixture of fume and paint-laden air and water is then whirled under the flood sheet and hurled with tremendous impact against the impingement wall at back of booth. Down this impingement wall flows an additional sheet of water that floods the foreign matter, pounded out in the process, into the sludge tank below. Only CLEAN AIR passes through exhaust fan. Thus the danger of fire is suppressed both in front and behind the flood sheet. Because the ratio of water and air is far greater in Centri-Merge, paint and other gummy substances do not pile up on the hard-to-get-at walls of the chamber behind the flood sheet; therefore, cost of repeated cleanings is eliminated.

Consult Schmieg engineers regarding your problems of dust and fume control.

THE *best* AIR PURGE is CENTRI-MERGE

Schmieg INDUSTRIES INC.
Engineers & Manufacturers
310 PIQUETTE AVENUE • DETROIT 2, MICHIGAN

General News

(*Continued from page* 90)

Tool Engineers Convention in Los Angeles

The American Society of Tool Engineers will hold its semi-annual convention in Los Angeles, Oct. 11-13. The theme of the convention will be "Progress on the Pacific." Technical sessions are scheduled for the nights of Oct. 11 and 12 with the national banquet to be held the night of Oct. 13. Paul Hibbard, vice-president and chief engineer of Lockheed Aircraft Corp., will talk on aircraft development and jet propulsion. Included on the program are tours of leading industrial plants in the area and an all-day tour of the Kaiser Steel Corp.

BIMETALLIC BRAKE DRUM

The Orenduff & Kappel Brake & Wheel Assembly in the above photograph shows the bimetallic nature of the Al-Fin Brake Drum.

The Al-Fin Div., Fairchild Engine and Airplane Corp., Farmingdale, N. Y., together with their licensee, the Light Alloys Div., Chicago Railway Equipment Co., have successfully completed the first phase of the development work on a bimetallic, aluminum bonded to cast iron automotive brake drum. Laboratory and dynamometer tests, it is said, have shown that this construction, under proper conditions of use, can reduce the inner drum temperature as much as 200 F, and that other tests have shown greaty increased brake liner life and greatly reduced fading effect during severe usage. This increased performance comes from the fact that the chemically bonded iron to aluminum interface offers no measurable resistance to the transfer of heat, and thus, it is claimed, the advantages of the very high heat conductivity of aluminum and an efficient extended surface design can be fully realized. The bimetallic brake drum weighs 75 to 80 per cent as much as a standard cast iron drum.

(*Turn to page* 96, *please*)

2,000,000 drivers use this jet constantly

— it's a safety aid for ALL cars, ALL seasons

Most drivers use their "Two Little Squirts" countless times during the year — for it takes only the touch of a button to wash off roadsplash, dirty mist, eye-dazzling dust.

Today more than *two million* are in use. Five leading car manufacturers answer the constantly increasing demand by installing Trico Automatic Windshield Washers at the factory. And fourteen makes have built-in provision for quick installation by car dealers or service shops.

Factory installed by Buick, Cadillac, Oldsmobile, Pontiac and Lincoln Cosmopolitan

TRICO

Trico Products Corporation, Buffalo 3, N. Y.

Windshield Washers

Fully automatic • Nothing to pump

General News

(*Continued from page* 94)

Crosley Powered M-18 Gets CAA Approval

The mass production of the M-18, a single-seat, ultra-light airplane, has been given the green light by the Civil Aeronautics Administration, it was recently announced by Crosley Motors, whose 26.5-hp automobile engine powers the plane. Designed by Al W. Mooney, veteran producer of the Culver Model V and many other Culver radio-controlled target planes, the M-18 resembles a midget fighter with its low wing design and retractable landing gear. Its primary feature is economy of operation, and it said that the M-18 has a flying range of 400 mi on a tank full of gasoline, eight gal. It is priced at $1600.

SHIPMENTS OF COMPLETE AIRCRAFT AND AIRCRAFT ENGINES AND OTHER PRODUCTS OF THEIR PLANTS*

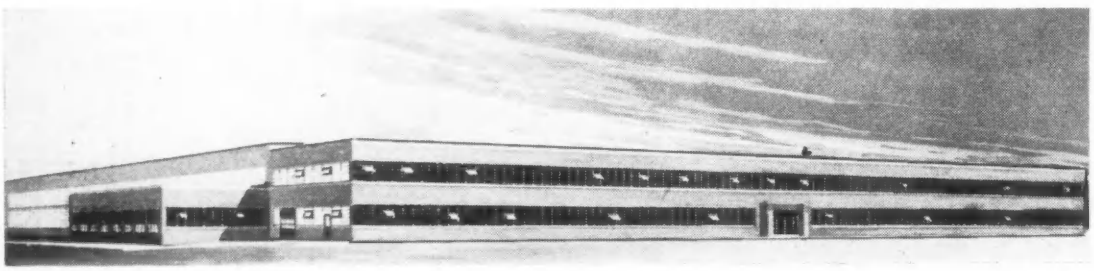
AIRCRAFT

	June	Six Months
Complete Aircraft	1,186	5,144
Military Aircraft		
Number of Planes	227	1,106
Civil Aircraft	959	4,038
Personal Plane		
Number	926	3,914
Value	$ 3,783,096	$16,611,913
Transport Planes		
Number	33	124
Value	$13,065,634	$45,978,447
Aircraft Parts—Value	$ 1,935,881	$11,583,166
All Other Products—Value	$ 3,028,418	$17,043,931
Total—Value of All Products	$21,813,029	$91,217,457

AIRCRAFT ENGINES

	June	Six Months
Military Engines		
Number of Engines	313	n.a.
Value of Engines	n.a.	n.a.
Value of Parts	n.a.	n.a.
Civil Engines		
Number of Engines	1,458	6,605
Value of Engines	$6,543,817	$22,270,951
Value of Parts	2,347,919	11,933,773
Total—Engines	1,771	n.a.
Total—Value of Engines	n.a.	n.a.
Total—Value of Parts	n.a.	n.a.
All Other Products—Value	$ 300,162	$ 1,086,506
Total—Value of All Products	$9,191,898	$35,291,230

*Bureau of the Census and Civil Aeronautics Administration, n.a.—Not available.



TRANSMISSION CONSTRUCTION

This architect's drawing shows the new plant to be built in Detroit for GM's Detroit Transmission Div. When completed, the plant will have 250,000 sq ft of floor space, and will employ about 1500 persons.

Here's a pocket edition catalog made to order for those engaged in the selection and purchase of washers and stampings . . . forty-six fact-packed pages of worth-while descriptive material, including illustrations of many of the more than 22,000 dies available in our plant to save you unnecessary die charges and delay. Write for your free copy, today. It will be sent to you without cost or obligation. Ask for Catalog No. 20.

WROUGHT WASHER MANUFACTURING CO.
The World's Largest Producer of Washers
2212 S. BAY ST., MILWAUKEE 7, WIS.

Obituary

Nicholas Dreystadt

Nicholas Dreystadt, 59, vice-president of General Motors Corp., and general manager of its Chevrolet Motor Div., died on Sept. 3, in Detroit.

H. William Kopf

H. William Kopf, 66, manager, Detroit Office, Pratt & Whitney Div., Niles-Bement-Pond Co., died on Aug. 13, in Detroit.

George Weidely

George Weidely, 77, pioneer Indianapolis automobile builder and engine designer, died on Aug. 29 in Carmel, Ind.

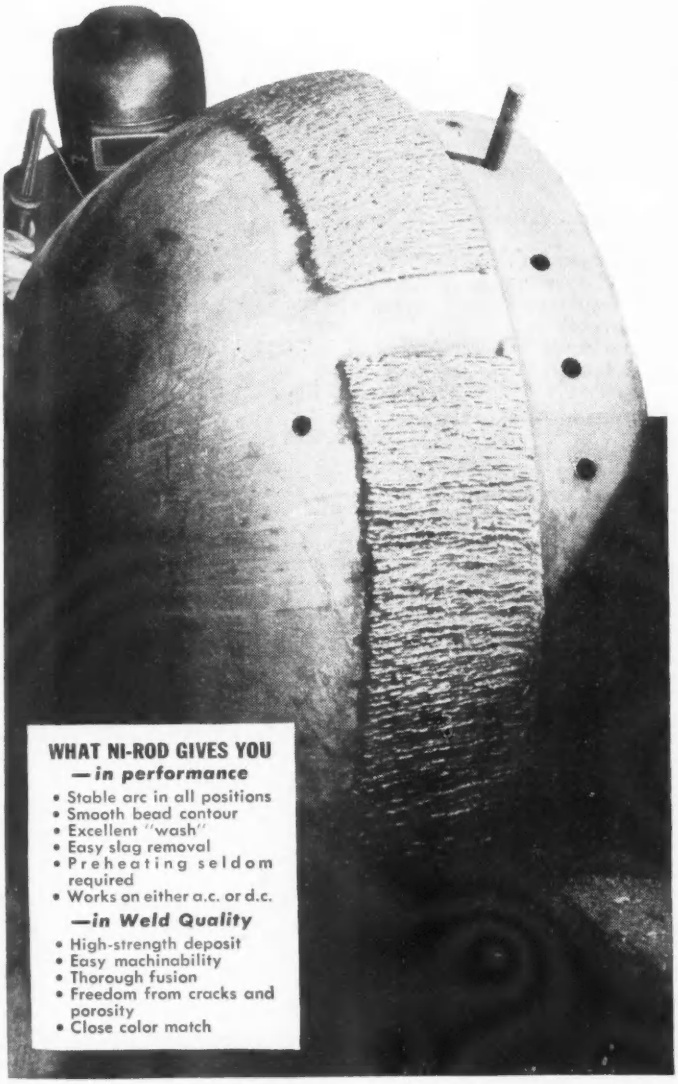
Elmer E. White

Elmer E. White, 52, sales engineer, Milwaukee, Wis., Pratt & Whitney Div., Niles-Bement-Pond Co., died on July 21, in Milwaukee.

Robert B. Hutchison

Robert B. Hutchison, 47, southeastern district sales manager, Willard Storage Battery Co., Atlanta, Ga., died in Decatur, Ga., on Aug. 22.

If it's CAST IRON you can weld it with NI-ROD


WHAT NI-ROD GIVES YOU
—in performance
• Stable arc in all positions
• Smooth bead contour
• Excellent "wash"
• Easy slag removal
• Preheating seldom required
• Works on either a.c. or d.c.
—in Weld Quality
• High-strength deposit
• Easy machinability
• Thorough fusion
• Freedom from cracks and porosity
• Close color match

NI-ROD WELDING ELECTRODES SUCCESSFULLY BUILT UP THIS WORN DIE

Dished heads are just one of the products of Lukens Steel Company, Coatesville, Pa.

They're formed with large hemispherical dies. Dies made of cast iron. Dies that are fairly expensive. When one wears down, Lukens' maintenance men try to restore the original contours.

For several years Lukens had used brazing to build up the worn areas. Then they tried Ni-Rod* welding electrodes because of good reports on its strength and easy machinability.

Here's what Lukens has to say about this repair job:

> **"With other wires, it was found that welds would pull loose from the casting when in use. Ni-Rod was the only electrode that could be used successfully. It would not pull loose when in operation, and had a very good wearing quality. We now use Ni-Rod for building up dies to insure good wear and where pressure on the die is involved."**

The welded die (before machining) is shown at the left. Note the smooth layer of Ni-Rod beads. Proof of Ni-Rod's easy handling!

*Reg. U. S. Pat. Off.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

TRY NI-ROD AT OUR EXPENSE!

Prove to yourself that Ni-Rod has taken cast iron welding out of the "hit-or-miss" class.

Send in the coupon and get 3 free electrodes. Try 'em on any cast iron job you have. See if they're not the easiest-handling electrodes you ever used to weld cast iron.

Time and time again, Ni-Rod can save you money in repairing damaged iron castings; in building up worn areas; in correcting machining errors; on the production line to join cast iron to steel.

SEND IN COUPON TODAY ➡

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

Gentlemen: I'd like to try Ni-Rod welding electrodes. Please send me 3 free rods of the diameter I have checked.

☐ 3/32" ☐ 1/8" ☐ 5/32" ☐ 3/16"
(Please check *one* size only)

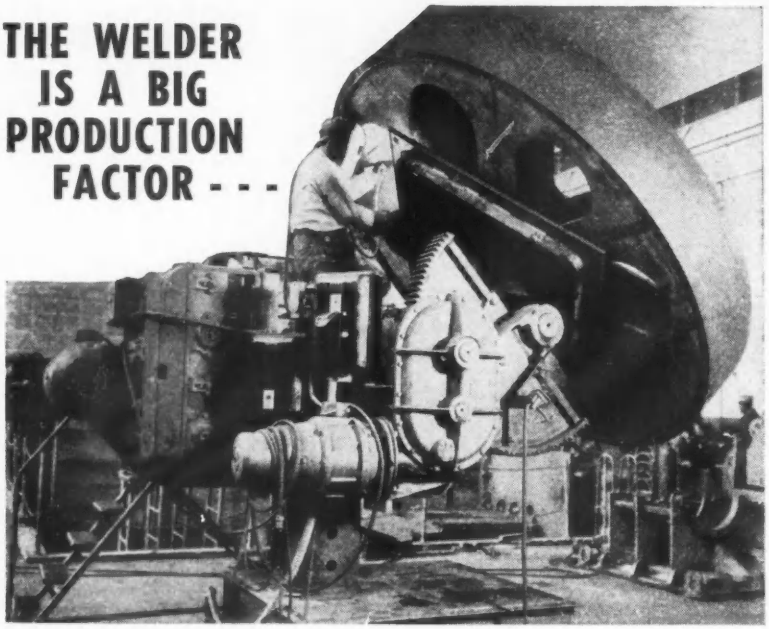
Name.....

Company..... A.I.-9-48

Address.....

City..... State.....

THE WELDER IS A BIG PRODUCTION FACTOR - - -



Your welders are *big* production factors when they work with C-F Welding Positioners because these power operated Positioners with variable speed table rotation are real production tools. Better automatic welding is possible because the C-F Variable Speed feature governs table rotation speed from 0 r.p.m. and up — assuring better control of fillet in circular or peripheral automatic welding.

If increased production, better downhand welding and lower costs in your welding department can help you meet the competition for new markets, C-F hand and/or power operated welding positioners should be your first choice. Write for Bulletin WP-24.

CULLEN-FRIESTEDT CO., 1322 S. KILBOURN, CHICAGO

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

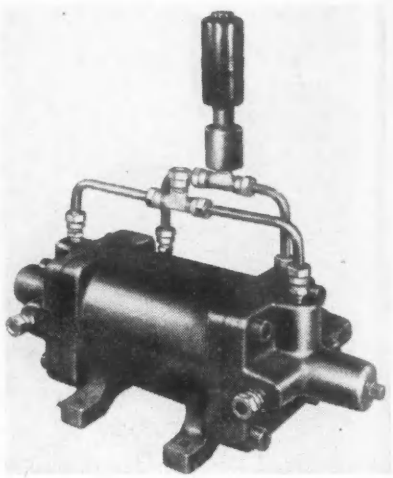
C-F positioned welds mean better, more economical welds

NEW EQUIPMENT

(*Continued from page* 56)

M-69—Air Actuated Intensifier

A major improvement for small hydraulic press operation is announced by Elmes Engineering Works, Chicago, Ill., in their new "Power-petuator,"



Elmes "Power-petuator"

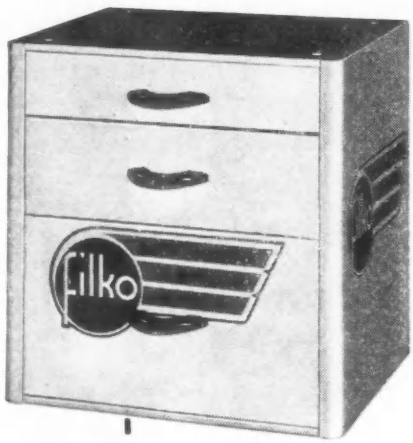
now standard equipment on all Elmes Hydrolairs. Consisting of an air actuated continuously changing intensifier, it is claimed to provide a continuous high pressure stroke and to maintain any desired pre-set ram pressure, even on compressible materials.

Typical applications are molding plastics and rubber, laminating and assembly forcing, forming and gluing, repetitive test work, and other purposes requiring up to 50 tons pressure.

Completely automatic, the Power-petuator builds up working pressure virtually instantaneously under principles similar to those of the steam reciprocating engine. A self-contained unit, it is placed out of the way at the

(*Turn to page* 100, *please*)

Write Today for Descriptive Folder

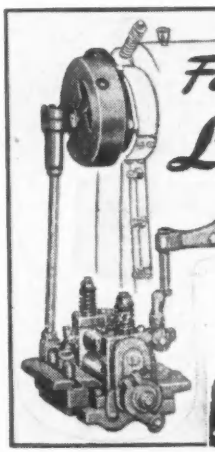


Buy Bonds

METAL MERCHANDISERS sell you product constantly

Focus attention at the point of sale with Central's custom-built "spot" merchandisers. They identify your product, create a desire for it . . . and sell! Any size, shape or style can be created for you by our master designing department . . . creators of metal merchandisers and displays for top manufacturers for over 36 years.

CENTRAL
Sheet Metal Works, Inc.
2645-49 Clybourn Ave.
Chicago 14, Ill.



Fast but accurate
Littell ROLL FEEDS
Style "M"

Simplify work for your die setters and press operators. Get easy-to-install Style "M" Roll Feeds. All the features of higher priced feeds. Positive, silent roller drive gives high speed with exceptional accuracy. One of many fine Littell pressroom machines. REQUEST BULLETIN.

F. J. LITTELL MACHINE CO.
4155 RAVENSWOOD AVE., CHICAGO 13, ILL.

Check Your Procedure

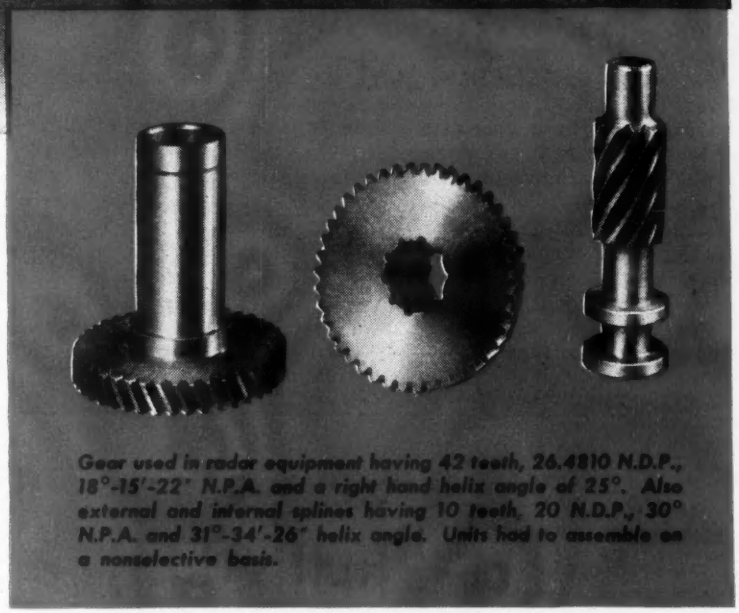
In The Red Ring Gear Laboratory

Before You Start Gear Production

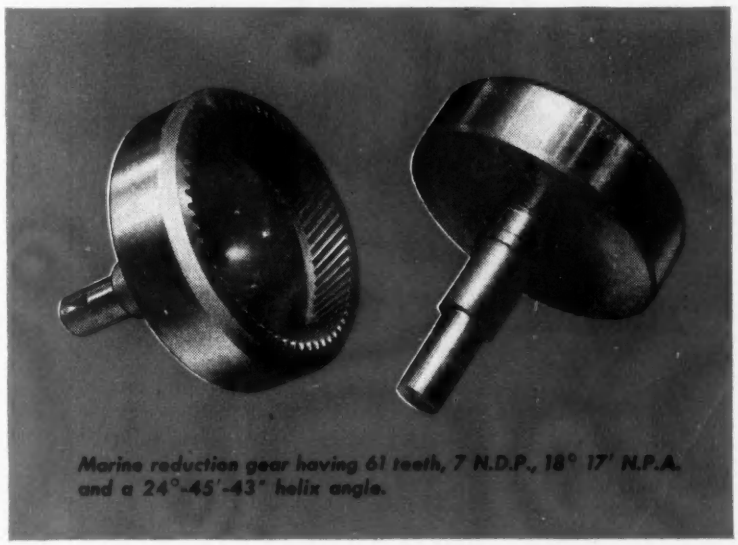
THE Red Ring Gear Laboratory has been organized for your convenience and assistance. You may have a pilot job you want produced or a limited number of special gears, perhaps gears having very close tolerances which you need for experimental or research work. You may have questions involving gear design, the choice of gear materials, methods of processing, heat treatment, or gear finishing.

The Red Ring Gear Laboratory, with its staff of gear specialists and full complement of gear processing machinery, can help you solve these problems and turn out gears for you in limited quantities—any type of spur or helical gear and to any degree of precision.

Red Ring Gear Engineers will be very glad to discuss with you any problem in this field. The gear laboratory is not set up for production runs of any type of gears.



Gear used in radar equipment having 42 teeth, 26.4810 N.D.P., 18°-15'-22" N.P.A. and a right hand helix angle of 25°. Also external and internal splines having 10 teeth, 20 N.D.P., 30° N.P.A. and 31°-34'-26" helix angle. Units had to assemble on a nonselective basis.



Marine reduction gear having 61 teeth, 7 N.D.P., 18° 17' N.P.A. and a 24°-45'-43" helix angle.

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • • • • • • • • • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

rear of bench-type Hydrolairs, and in the base of floor types. Packless construction is said to eliminate a common source of trouble.

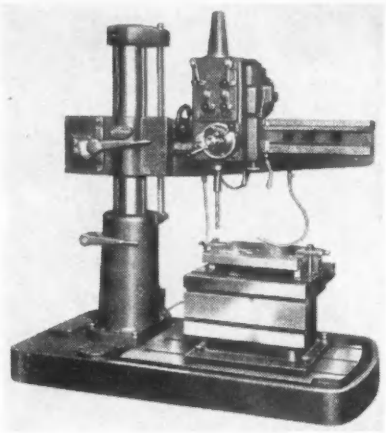
The unit takes its power entirely from the shop air line. Air requirements are said to be negligible.

M-70—Bantam Size Drill Press

The Canedy-Otto Mfg. Co., Chicago Heights, Ill., announces a new "Bantam" size drill press, with a maximum operating capacity of 1 in. in cast iron. The new size is said to be the outgrowth of a study revealing that 99.3 per cent of all radial drilling done is within the 1 in. range.

The new unit is available with a 3 ft arm and 7 in. column, has nine spindle speeds, is equipped with a single speed motor and six rates of power feed. Two motors are used; one main driving motor for the head mechanism and one fractional hp motor for the power elevating mechanism of the arm. The unit has a base of semi-cast steel casting, with integrally cast tank for adaptation of a coolant system. The 7 in. column is of tubular steel, ends welded into position.

Feed transmission is an independent unit held in position and proper gear mesh with the pick-off power transmission gears, and is easily accessible for maintenance. Feed clutch is a complete and independent unit, which permits feeding either downward or upward. Main drive clutch is a multiple disk friction dual type, offering forward and reverse rotation for convenience in tapping. Spindle is of alloy steel hardened and ground and provided with multiple spline, counterbalanced within the head by an adjustable clock spring. Morse taper bore of spindle is No. 3.



Canedy-Otto "bantam" size radial drill press

M-71—Double Crank Gap Frame Presses

The Niagara Machine & Tool Works, Buffalo, N. Y., has put out a new line of welded steel gap frame double crank presses, said to combine convenience of a "C" frame and the width and stability of the double crank press. The short strokes, rigid box crown and deep bed make it suitable for use with fine blanking dies and for forming work requiring heavy load at the bottom of the stroke. Long or irregular sheets and strips can be fed either front to back or right to left as the bed is equally accessible.

On geared presses, the back shaft does not cross the press, but is mounted in anti-friction bearings and entirely supported by the right hand upright. The pinion is supported between anti-friction bearings, thus holding the back shaft in alignment with the main gear.

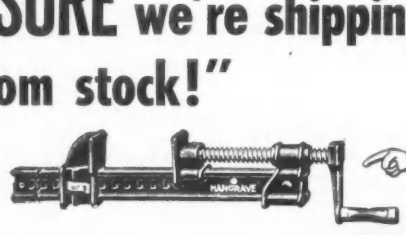
Other features include a welded all steel frame and slide, the Niagara 14-point engagement sleeve clutch, anti-friction bearings in the clutch wheel, air counter-balance for slide, and a compensating and indicating brake. The presses are built in seven sizes ranging in capacity from 44 to 244 tons. Machines in each size are made in five to six widths.

Why: Because individual hand wrapping and rust-proofing procedures are eliminated. Plastic-Seal is a tough, pliable, hot-dip coating, easily applied by dipping the object into the molten material and removing almost instantly. The resulting skin-tight film is moisture-proof and protects precision, highly finished surfaces or fragile materials against corrosion and physical damage. No further packaging is required. Transparency makes inspection easy and provides instant identification. Write for full information. Ask for bulletin 1047.

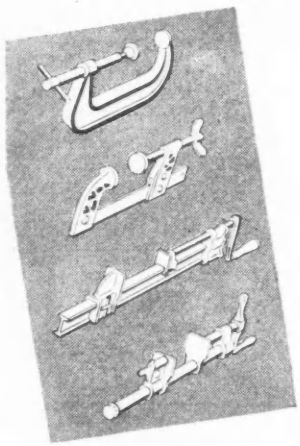
PS PRESERVE PROTECT PACKAGE with Plastic Seal

GLOBE IMPERIAL CORPORATION 2010 KISHWAUKEE ST. ROCKFORD, ILLINOIS

"SURE we're shipping from stock!"



HARGRAVE "I" BAR CLAMPS (Patented)



No Waits—No Delays! Now you can again obtain immediate delivery of these favorite industrial clamps.

The Hargrave "I" Bar Clamp is designed for the hard, every day grind of production. It is rapid and powerful. Notches in web permit quick action, no slipping. Screw is steel, heat treated to prevent battering of thread. Openings from 2 feet to 10 feet.

Write for Catalog of complete line.

SEE YOUR NEARBY INDUSTRIAL DISTRIBUTOR

HARGRAVE The Cincinnati Tool Co.

4056 Montgomery Road
Cincinnati 12, Ohio